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EXPERIMENTS WITH VIBRATING CILIA.

BY JEFFRIES WYMAN, M.D.

The motions of vibrating cilia, and their action on the water around them, are among the most beautiful sights shown by the microscope. They are best seen on the respiratory surfaces of both land and aquatic animals, and of the last, the gills of the Mytili are especially favorable for examination. In such cases, the effects are confined to the movement of the secreted mucus, or of the surrounding water, and the particles floating in it, while in others the cilia cover the outer surface and become the chief organs of locomotion, as in the Infusoria. In the eggs of Radiates and Molluscs, as in the remarkable phenomenon of the rotation of the yolk, much larger masses are moved, and among Batrachians, the yolk, soon after impregnation and segmentation, being large enough to be easily watched with the naked eye, is seen to revolve steadily under ciliary influence. Even the recently hatched larvæ of frogs and toads are carried along bodily by the same agents distributed over the whole outward surface, without the slightest aid from the muscular system. In all of these instances, however, although in some the mass moved is considerable, the motion takes place in a fluid, of nearly the same specific gravity as the objects, and so the force required to give the motion is exceedingly small. Indeed everything serves to give the impression that cilia are capable of exerting only the

most delicate efforts. There are several ways in which their effects may be shown without the aid of the microscope, but the most common is that of sprinkling some light powder over the ciliated membrane, from which the powder is soon swept away. The object of this paper is to explain some other methods adapted to class experiments having the same end in view, but by which motion is imparted to much larger masses, and also to show that in some instances a much greater resistance can be overcome than has generally been supposed possible.

I. *Experiments in water.* — For these the gills of Unios and Anodontas are well suited. Their cilia are quite active, and vibrate in such directions, that on the inner gill the motion is *from* the free edge, and on the outer *to* it, facts which the experimenter should keep in mind. If an *inner* gill is cut away from its attachment and laid on the bottom of a flat dish, its cilia acting as legs, it will soon begin to move with its *free* edge forwards, and will in the course of time, travel the entire length of the dish. We have seen a whole gill move ten inches in four hours. Under similar circumstances the *outer* gill will move with its base or *cut* edge forwards. This difference depends, as will be readily seen, upon the fact that the cilia of the two gills vibrate in opposite directions.

The result of ten experiments gave the rate of motion of a piece of gill measuring 12mm. by 14mm., 6mm. a minute. If two outer gills are laid with their free edges towards each other they will at once begin to approach, and it frequently happens after meeting that one crawls directly over the other.

Another and more striking experiment which shows the reaction of cilia on each other may be made as follows. Fasten a gill to a piece of cork under water, and place upon it a portion of a second gill about a half inch square. If this piece is so placed that the cilia vibrate in the same direction with those of the gill below, it will remain stationary, or nearly so, since the cilia offer no resistance to each other. If now the upper piece is reversed so that the cilia vibrate in opposite directions, the upper piece will move with double the speed and through twice the distance in a given time that it would with its own cilia alone, for while the lower cilia move the upper piece through a certain space, the cilia of the upper piece also move this in addition through an equal space. A third form of this experiment consists in placing the upper piece so that its cilia vibrate at right angles to those of the

lower. In this case, while the lower cilia tend to move the upper piece from side to side, those of the upper tend to move this lengthwise of the lower. The direction which the upper piece takes, is a resultant one, viz., intermediate between the two.

II. *Experiments in air.* Though the tissues of the gills of Unios and Anodontas are quite soft and incapable of resisting other than very light weights, they will nevertheless carry small discs of paper supporting a bristle, on the top of which is a small pellet of cotton or a flag of tissue paper. In order to show the flag more distinctly, a board painted black should be nailed to the edge of the one on which the gill rests, to make a back ground. With this precaution the experiment may be seen over a large room. To mark the distance traversed, a pointer of white paper should be set up on the board supporting the gill and at the beginning of the experiment, the end of the pointer brought in contact with the end of the flag on the gill. When left to itself, the disc on the gill with its flag at once begins to move to the opposite side and the flag is seen to recede from the pointer. The distance traversed may be increased to several inches, by placing two or more gills side by side, the free edge of the first slightly overlapping the cut edge of the second, etc.

The mucous membrane from the roof of the mouth of frogs, is much more solid than the gills of Unios, and the cilia vibrate with much greater force. Different ciliated membranes exert very different degrees of force, but we have found none better suited for experiments than that just mentioned; especially, when taken from the mouth of the bull frog which gives a large surface. It has the advantage, too, of keeping up its activity for twenty-four hours or more, after being detached from its natural connections, if only kept cool and moist. For moistening it water answers sufficiently well, but the serum of the blood of the frog is still better.

The attention of the writer was first called to the possibility of moving weights much larger than was supposed possible by noticing the ease with which a piece of skin which was accidentally placed upon the ciliated membrane was swept off. By loading the piece of skin with weights the mass moved was found to be unexpectedly large.

In making experiments for the purpose just mentioned we have adopted the following method. The mucous membrane, being

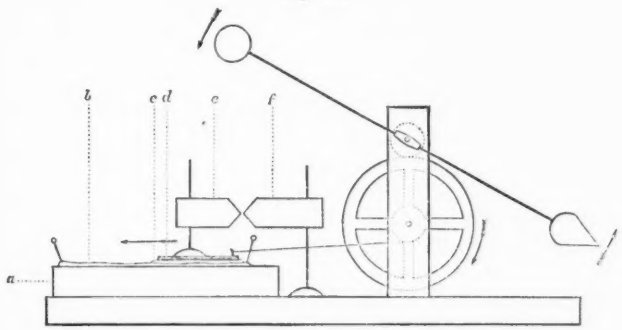
carefully dissected from the roof of the mouth, is pinned to a board. A piece of skin from near the throat of the frog, and from one-third to half an inch square, is placed upon this membrane with the inner surface in contact with the cilia, it being kept in mind that these vibrate from before backwards towards the throat. On the skin may be placed a plate of lead of somewhat smaller size. This serves as a vehicle to which weights may be added at will to increase the load, and also as a drag, to set in motion the instrument described farther on. To show the distance through which the load is carried, the flag and pointer may be used as in the case of the gills before described. Pains should be taken to have the board on which the experiment is made perfectly horizontal, otherwise a sliding motion, especially when heavy weights are used, may come in to vitiate the experiment.

Although the results are not uniform, the following will give some idea of the force exerted, as shown by the time in which and the distance through which the weight was carried. The mean of four experiments shows that a weight of 1.300 grams was carried 15mm. in 61.2 seconds, or about 4mm. per second, the weight resting on a surface 12mm. square. A weight of thirty-three grams resting on the same amount of surface, a mean of four experiments gave a distance of 6.6mm. per minute. We have seen forty-eight grams resting on a surface 14mm. square, moved, though very slowly, across the whole length of the membrane, but the exact time was not noted. Dr. H. P. Bowditch has repeated these experiments in the laboratory of Ludwig at Leipsic with even heavier loads.

Finding that so much force was exerted, the idea of utilizing it was naturally suggested, and after various trials the following instrument was devised for this purpose, in which the direct motion produced by the cilia was made to give rise to a rotary one. The instrument consists of two light toothed wheels (see figure), the larger 30mm. and the smaller 5mm. in diameter. To the axis of the first is attached a small drum 5mm. in diameter, around which is coiled a thread of the finest and most flexible cotton. The axis of the smaller wheel is prolonged through the frame in which both wheels move, and carries on its end an index made of two bristles inserted into a central piece of cork, which is attached to the axis. On the end of each bristle is a very light paper pointer. The whole length of the index is 110mm. but may be made longer

or shorter than this, as may be convenient to the experimenter. Behind the instrument there should be a small black board attached to the base on which the frame rests, to serve as a background against which the pointers are seen. The instrument is of sufficient delicacy to be moved by a weight of from one hundred to one hundred and twenty millegrams or of from seven to eight grains. All that is necessary to make an experiment is to attach the end of the thread coiled around the drum to the hook on the lead which rests on the piece of skin, which in turn rests on the membrane. The proportions of the wheels are such, that when the load resting on the membrane is carried through a space of 7mm. the index makes two whole revolutions, and the point of the index moves through a space of about two feet. One complete revolution is effected in about thirty seconds. This motion may be easily seen over a large lecture room.

Fig. 110.



Description of the diagram. *a*. A movable block of wood to which the ciliated membrane is pinned. *b*. Ciliated membrane. *c*. Piece of skin resting upon it. *d*. Plate of lead with a small hook to which the thread coiled around the drum is attached. *e*. and *f*. Pointers, one resting on the lead and the other on the board to which the instrument is fastened; these are made of wire inserted into a base of wood or cork, and carry each a piece of paper or thin card; both are movable. The wheels are toothed. Attached to the axis of the large wheel is the drum, and to the projecting portion of the axis of the small wheel is the index.

This figure is one-half the size of the instrument. The base on

which the instrument rests, should be made longer than in the figure so that the block to which the membrane is attached may be farther off from the wheels.

THE GRASSES.

BY W. W. BAILEY.

The earliest, as well as the latest sign of vegetable life is, perhaps, afforded by the grasses, whose green blades form the sward which we all so much admire. Did it ever occur to all our readers that these humble plants which form our out-door carpet or which are cultivated for forage, have flowers, often as beautiful in their way as any of their proud associates? All are aware that the tasselled heads and silky plumes of the Indian-corn are beautiful, and gaze with delight upon a sea of grain when rippled by the gentler breezes or thrown into billows by the more wrathful. When another season shall present the opportunity, let those who are beginning timidly to woo Dame Nature, examine more closely the beauty which the grasses offer, and we think that they will thank us for the advice. To study them understandingly, it will be necessary to be provided with an ordinary field microscope of one or two lenses, and if in addition, the observer happens to possess a compound instrument for the examination of the minuter parts, he will find it very serviceable.

A few words as to the structure of grasses, and the points in which they differ from other plants may be of interest, and while speaking of them, we will add a word about the sedge family,—their very next of kin. Both of these natural orders are so large, and the species so varied, that the study of them has become a specialty, and many men devote their whole lives to arranging and simplifying our knowledge of the classes, learning their habits, and ascertaining how the useful species may be made more serviceable and the valueless eradicated. Although we are not one of these specialists, we will try to give a familiar, and at the same time an accurate account of the structure of both grasses and sedges, referring, when in doubt, to those whose word is law.

The sedge family comes first in order, and includes the sedges proper, the bulrushes, cotton-grasses, and many other more or less familiar plants, all resembling the grasses, yet differing from them in essential particulars. The greater part of them have solid stems, called culms, around which the leaves form a closed sheath. The flowers are in spikes, have no calyx or corolla, and possess three stamens. The stem leaves, when present, are three-ranked, and the stems sharply angled. The fruit is one-seeded and forms what is technically known as an achene. The small beaked nutlets heaped up in the centre of a buttercup, will give an idea of an achene as it occurs in a totally different order of plants. Sedges may be regarded as weeds in every sense of the term, and their prevalence is an indication of swampy and poor ground. Unlike grasses, they are quite devoid of nutritious properties as a rule, and are shunned by animals when any thing else is obtainable. Independent of their occasional use in the manufacture of baskets, they have scarcely any economic value. The papyrus of the Nile, from which paper and boats were made, is a somewhat famous exception to their general uselessness. Unfit though they may be to minister in any way to the benefit of man, they are yet, in their infinite variety and exceeding grace, most charming to any one whose attention has been once directed to them.

Let us now pass to the grasses. Bearing in mind the several points of the above description, let us see how these differ from their near relations. Put them side by side and compare them. It will be seen that the grasses, unlike the sedges, have hollow stems swollen and closed at the joints, with two-ranked leaves, having many fine veins running parallel to the central vein or mid-rib, and split sheaths, the tops of which are prolonged into an appendage known as a "ligule," from a Latin word signifying a shoe-strap. The flowers are arranged in spikes as in the timothy (Phleum), or in panicles as in the bent grass (Agrostis). These spikes and panicles differ greatly as to their concentration or diffusion, and the flowers themselves as to their appendages. Some are armed with long awns or bristles as in the barley and oats—and we wish here to testify that these are about as awkward things to swallow as in our juvenile days we ever tried. The stamens are usually three, with anthers or pollen cases attached only by one point, and therefore swinging freely. The styles are mostly two, with feathery stigmas which form charming micros-

copic objects. In common with sedges, the grasses have fibrous roots. To describe the flowers, without the use of actual specimens or drawings, is a difficult matter. Let the following quotation supplement the above remarks:

"A few rudimentary leaves collected at the ends of the branches of inflorescence and constituting flowers, a very small number of stamens inclosed in a thin pericarp [skin or walls of the fruit], are all that nature provides to enable these plants to preserve their race and to distinguish their numerous kinds from one another. Yet with such a simple apparatus, many thousand species are so precisely characterized, that the natural order of grasses is perhaps one of the easiest to study and arrange, provided the task be commenced upon right principles."

There is, despite the above statement, scarcely an order more dreaded by the young student. It is a good test of his love for science and severe application, if he persistently investigates it. It contains three thousand or more species generally diffused over the earth.

With us, the plants are usually small and grow close together, forming a mat, though even here there is much diversity in the habit of growth, the Aira or hair-grass, for instance, forming isolated clumps. In the tropics the plants are often much larger —the bamboo sometimes attaining a length of ninety feet—and there is little or no tendency to form a sward.

It is useless to speak of the value of the grass family to man. It is enough to say that it produces all the cereal grains, most of the forage plants, the valued sugar-cane, and the bamboo, applied by the natives of the East to such a multiplicity of purposes, that we are led to wonder if they could survive without it. Man by observing processes of nature, has in some cases usefully applied certain species of grass to prevent the encroachments of the sea, the fibrous and interlacing roots serving admirably to bind the shifting sands. No injurious properties are known positively to appertain to the order, except in the case of the darnel (*Lolium tennulentum*), the fruit of which is acknowledged to be pernicious.

Of our common grasses there are many that are beautiful, none more so to our thinking than the wild rice (Zizania), which we have often admired on our northern rivers as it nodded over the passing row-boat. The flowers are larger than usual in this genus, and are elegantly marked with light bands of red. It is curious how

many fanciful resemblances one sees in plants. We were lately quite provoked to find that Winthrop, with whom we certainly never had conversed, had hit upon an idea which we esteemed peculiarly our own. It was the comparison of the heads of timothy to cannon sponges. Many other curious similitudes have been observed, nor has man in his architectural and ornamental workmanship, begun to avail himself of one quarter of the lovely models at all times displayed before him.

If one makes a bouquet consisting alone of grasses, he will soon perceive how beautiful they really are. The panics and herd's grasses are especially lovely, both in the fields, which some of them tinge with their ruddy smoke, and in the vase at home, where their ethereal delicacy can be more closely noted.

The grasses are so numerous that it is impossible to refer even briefly to one quarter of them. We can only give our advice to "go and look them up."

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE VALLEY OF QUITO.—No. I.

BY PROFESSOR JAMES ORTON.

The Geographical Distribution of organized beings is one of the unfinished chapters of natural history. Much has been done within the last twenty years in defining zoological and phytological provinces; but we are still very far from knowing the precise range of species. This has arisen partly from the failure of collectors to give exact localities, and partly from the ignorance of home naturalists, who often confound places hundreds of miles distant. The vast collections of Fraser, *e. g.*, are of little use in determining distribution, as in many cases the indefinite habitat, "Andes of Ecuador," is given, which may mean the Pacific slope, the headwaters of the Amazon, or the Quito Valley—three regions quite distinct in physical aspect.* On the other hand, those who determined his specimens have in some cases located them indiscrimi-

*The term *Andes* strictly belongs to the Eastern range, and *Cordillera* to the western; but this distinction is not always observed.

nately on either side of the Andes, from an ignorance of the geography of the country. Our generalizations lose half their value from this want of care and precision. "Could we only know the range of a single animal as accurately as Alphonse De Candolle has lately determined that of many species of plants, we might begin a new era in Zoology. It is greatly to be regretted that in most works, containing the scientific results of explorations of distant countries, only new species are described, when the enumeration of those already known might have added invaluable information respecting their Geographical Distribution."*

The importance of every fact relating to the natural limits of animals and plants is felt in its bearing on the great question of the day — the origin of species. Whether "all the grand leading facts of geographical distribution are explicable on the theory of migration, together with subsequent modification and the multiplication of new forms,"† cannot be safely answered until we have more precise as well as more extensive knowledge of habitats. We should know more thoroughly the conditions which favor migration, as also the effect of barriers in preventing the spread of species, and "the narrowest limits within which animals of different types may be circumscribed."

The following contributions are based mainly on the writer's personal observations. So far as we know, no attempt has been made to form a synopsis of the life in the region described; and it is hoped that this list may serve as the foundation of a more perfect work. The Valley of Quito is selected because it is a remarkably well-defined district, having a uniform temperate climate. It is nearly three hundred and fifty miles in length, stretching from 1° N. to 4° S., and has an average width of forty miles, being walled in by the grandest group of volcanic mountains in the world. These barriers have an average elevation of 12,000 feet above the sea, and are broken at few points, chiefly by the narrow gorges of the Santiago and Pastassa, and the sources of the Mira and Esmeraldos. The valley is subdivided by ridges into three basins — Quito, Ambato and Cuenca, having the respective altitudes of 9500, 8000 and 7500 feet, and mean temperature of 59°, 61° and 62°. At Quito the thermometric range in twenty-four hours is

* Agassiz, *Essay on Classification*, p. 35.
† Darwin, *Origin of Species*, p. 355.

about 10°; and the extremes in a year are 45° and 70°. The mean annual fall of rain is 70 inches.

The region belongs to Sclater's "Neotropical"; more particularly, it is the northern part of Schmarda's subdivision—"the country of llamas and condors." When we have full returns, it will be interesting to compare life in the Quito Valley with the nature and relative proportion of inhabitants in oceanic islands. Darwin has pointed out the important lessons which may be learned from the natural history of the latter; and the study of isolated mountain districts is of nearly equal value. It is certainly of interest to ascertain whether the organic productions of the Andean Valley, like the endemic forms of the Galapagos Is., have a special adaptability for migration. The proportion of species to genera in islands is smaller than in continents; how in this respect does Quito compare with Amazonia? The vertebrates of South America are remarkably restricted in their range: does this show that the continent has been lately split up into isolated districts?

MAMMALS.

Nearly all the quadrupeds seen in the Valley have been introduced from Europe, as the horse, ass (mule), ox,* goat, sheep (two, four and six-horned), hog, dog and cat. The horse, ox and dog flourish at the highest inhabited altitude, or 13,300 feet. Quito cats are no mousers; dogs are far superior. Six orders are represented by the indigenous forms; but the following list of species is very incomplete. Years of observation in every part of the valley, from Ibarra to Loja, and up to the snow-line are necessary to finish the work. The largest mammal is the llama, always domesticated. The equine and ovine races are fast superseding it. It is usually of a dark brown color; but one of pure white is occasionally seen. The llama is not taken, we believe, as high up as the Hacienda of Antisana. A deer (*Coassus rufus* F. Cuv.?) occurs particularly about Lake Sn. Pablo at the foot of Imbabura. The *Tapirus Roulini* Fisch., possibly visits the vicinity of Loja; but its proper place is on the eastern slope. Of carnivores, the only certified examples are the puma which fol-

*The prevailing colors of the cattle are white and liver-color. "I have often observed (writes an old English resident), that the cattle in general are much lighter-colored than in England; even black has a blue cast. I have never seen one that would be called jet black." The majority of dogs are white or light brown curs.

lows the deer into the valley, a large brown weasel with a light colored belly, and the skunk, *Thiosmus mesoleuca* Licht. (var. *Quitensis* Humb.?) called by the natives "zoro" or Indian fox. The last is of a grayish color with black longitudinal bars. "All the South American *Canidæ* belong to the dogs" says Murray; but on the slope of Chimborazo we caught sight of an animal which had a very close resemblance to a true fox. The small black bear of the Cordilleras is not known to enter the valley. It does not exceed one hundred and sixty pounds in weight. Bats are not numerous, but there are doubtless several species. The only one we have examined appears to be a *Nycticejus*. The *Cavia cobaya* Schr. (domesticated) is wonderfully prolific. The "cuye del monte" of the natives is confined, we believe, to the warm western slope. It is four times as large as the common guinea-pig, and covered with a thin coat of long hair, mingled brown and black. We observed a hare, perhaps the *Lepus Brasiliensis* Linn., the only one determined from South America. The squirrels, which are not uncommon, are probably distinct from the *Sciurus æstuans* of Brazil. Compared with their number in other regions, mice (*Hesperomyinæ*) may be considered rare: their scarcity may be due to the multiplication of the guinea-pigs. Of opossums we obtained two species; *Didelphys Azaræ* Tern., and *D. philander* Linn.?

The palæontology of the valley of Quito has not been fully developed; but enough is known to excite deep interest in the ancient life on the top of the Andes. At Alangasi, near Quito, a large mastodon tooth was found many years ago; but the most extensive mammiferous deposit is at Punin, seven miles southwest of Riobamba. The bones are imbedded in an uns'ratified cliff, four hundred feet high, of very compact silt or trachytic clay. They were evidently drifted to the spot and deposited (many of them in a broken state, and none in their proper relative positions) in horizontal layers along with recent shells. In 1867, the writer took out a large collection * which included vertebræ, patellæ and femur (solid!) of mastodons, adult and young; vertebræ, leg bones and upper and lower jaws of two horses, one of ordinary size, the other about as large as the ass; vertebræ, leg bones and ischium of a llama or some auchenia; metatarsal like and large

*Now in the Museum of Yale College. A collection, strikingly similar excepting the mastodon, has been recently found at Table Mountain, Tuolumne Co., California.

as those of the camel; leg bones, jaw and teeth of a deer; remains of an unknown ruminant; and a small, hollow bone resembling the tibia of a bird. We are surprised at the absence of hollow-horned Ruminants, Rodents and Edentates which abounded in the Pleistocene of the Atlantic side. "Undoubtedly [says Darwin], the climate of the Cordilleras must have been different when the mastodon inhabited it." We think, however, the great pachyderm would have had little difficulty in thriving at the present day at Quito, on the score of temperature or altitude. But the vegetation is hardly sufficient.

BIRDS.

The avi-fauna is better known; and the following catalogue is believed to be nearly complete. It does not include all the stragglers; and other residents may be added from Loja which has not been thoroughly explored. Introduced species, as geese and poultry, are of course omitted. Those marked (*) were not obtained by the writer but are added on good authority; such as are considered restricted to the valley are indicated by a dagger (†). The further known range of the migratory ones is also added.

Turdidæ:
- Turdus gigas Fras. — New Granada.
- * " chiguanco Lafr. — Peru.
- " Swainsoni Cab. — From Greenland [to Peru.

Hydrobatidæ:
- Cinclus leuconotus Scl. — New Grenada.

Troglodytidæ:
- †* Thryothorus euophrys Scl.
- †* " mysticalis Scl.
- Troglodytes solstitialis Sch.—Pacific slope?
- † Cistothorus æquatorialis Lawr.
- † Cinnicerthia unibrunnea Lafr.
- " canifrons Lafr.—New Granada.

Pteroptochidæ:
- Triptorhinus orthonyx Lafr. — New Gra- [nada.

Mniotiltidæ:
- Mniotilta varia Linn. — United States to [Peru.
- Basileuterus nigricapillus Lafr. — Bolivia.
- " coronatus Tsch. — Peru.
- Setophaga ruficoronata Kaup.— New Granada.
- Dendroica Blackburniæ Gm. — United [States to Peru.

Hirundinidæ:
- †* Petrochelidon murina Cass.
- " cyanoleuca Vieill.— Bolivia, [Chili, Brazil, Paraguay.

Coerebidæ:
- Diglossa aterrima Lafr. — New Granada.
- " humeralis Fras. — New Granada.
- " Lafresnayi Boiss.—New Granada.
- " personata Fras. — New Granada. [Peru.
- " similis Lafr.— New Granada.
- Dacnis pulcherrima Scl. — New Granada.
- †* Oreomanes Fraseri Scl.
- † Conirostrum Fraseri Scl.

Tanagridæ:
- Tanagra Darwini Bp. — Peru.
- Pyranga æstiva Gm. — Canada to equator.
- Calliste atricapilla Lafr. — New Granada. [Venezuela.
- Dubusia taeniata Boiss. — New Granada.
- Iridornis dubusia Bp. — New Granada.
- Psittospiza Riefferi Boiss. — New Granada. [Peru.
- Buarremon assimilis Boiss.—New Granada.
- " latinuchus Du Bus. — Peru.
- * " pallidinuchus Boiss.—New Gra- [nada.
- * " schistaceus Boiss. — New Gra- [nada.
- " leucopterus Jard. —Nanegal.
- Buthraupis Edwardsii Ell.—New Granada.
- " cucullata Jard.—New Granada.
- † " chloronota Scl.
- Chlosospingus atripileus Lafr. — New Gra- [nada.
- " superciliaris Lafr. — New [Granada.
- " canigularis Lafr. — New [Granada.
- Chlorochrysa calliparaea Tsch.—New Gra- [nada, Peru.
- † Compsocoma cyanoptera Cab.
- " notabilis Jard.
- †* " sumptuosa Less. — Peru, Ven- [ezuela.
- " victorini Lafr.—New Granada.
- Diva vassori Boiss. — New Granada.
- Euphonia nigricollis Vieill. — New Gra- [nada, Venezuela, Brazil.
- † Pœcilothraupis atricrissa Cab.
- * " lunulata Du Bus. — New [Granada, Peru.

Fringillidæ:
- Catamblyrhynchus diadema Lafr. — New [Granada.
- †* Catamenia analoides Lafr.
- " homochroa Scl.
- * Chrysomitris icterica Licht.
- " Magellanicus Vieill.—United [States? South America.

* Pheuticus aureiventris Lafr.
† " chrysogaster Less.
* Phrygilus alaudinus Kitt.
* " ocularis Scl.
* " unicolor Lafr. et D'Orb.—Bolivia, [Chili.
Sycalis arvensis Kitt. — Chili.
Zonotrichia pileata Bodd.

Icteridæ:
* Cassiculus leucorhamphus Bp.— New Gra- [nada.
* Sturnella bellicosa De Fil.

Corvidæ:
Cyanocitta turcosa Bp. — New Granada.

Dendrocolaptidæ:
* Synallaxis Antisiensis Scl.
" elegantior Scl.—New Granada.
† " flammulata Jard.
†* Cinclodes albidiventris Scl.
†* " excelsior Scl.
Margarornis squamiger Lafr. — Bolivia.
† Ochetorhynchus excelsior Scl.
Picolaptes lacrymiger Lafr. — New Gra- [nada.
Pseudocolaptes Boissoneautii Lafr.— New [Granada, Peru.

Formicariidæ:
Grallaria hypoleuca Scl. — New Granada.
" monticola Lafr. — New Granada.
* " Quitensis Less.
" ruficapilla Lafr. — New Granada.
" squamigera Prev. — New Gra- [nada.

Tyrannidæ:
†* Agriornis audicola Scl.
† " solitaria Scl.
* Elainia griseogularis Scl.— New Granada, [Chili.
†Mecocerculus amoenus Scl.
* " stictoptera Scl. — New Gra- [nada.
* Muscisaxicola albifrons Tsch. — Peru.
" cinerea Phil. — Chili.
* " maculirostris Lafr. — Boli- [via and Chili.
†Myiarchus nigriceps Scl.
* Myiobius cinnamomeus Lafr. — New Gra- [nada, Bolivia.
†Myiothesetes erythropygius Scl.
Myiozeta Guiavensis Cab. — New Granada.
Ochthoeca fumicolor Scl. — New Granada.
" fumigata Boiss. — New Granada.
" Lessoni Scl. — New Granada.
† " rufimarginata Lawr.
Pyrocephalus manus Gould. — Puna Is., [Galapagos Is.
* Sayornis cinerascea Lafr. — Venezuela.
Serpophaga cinerea Str. — New Granada, [Brazil.
* " parula Kitt. — Bolivia, Chile, [Patagonia.

Cotingidæ:
Ampelion arcuatus Lafr. — New Granada.
" rubrocristata L. et D'O. — New [Granada, Bolivia.
Cotinga cincta Bodd. — Guiana, Brazil.
Pipreola melanoluma Scl. — Venezuela.
" Riefferi Boiss. — New Granada.
* Tityra dorsalis Scl. — New Granada.

Alcedinidæ:
Ceryle torquata Linn. — Peru, Bolivia, [Brazil, Arg. Republic.

Galbulidæ:
* Galbula chalcothorax Scl. — Napo?
* " castanoptectus? — Brazil.

Trogonidæ:
Trogon Antisianus D'Orb. — Napo? New [Granada.
* " personatus Gould — New Gra- [nada, Brazil.

Caprimulgidæ:
Antrostomus nigrescens Cab. — New Gra- [nada, Guiana.

Cypselidæ:
Chætura rutila Vieill. — New Granada, [Guatemala, Trinidad.

Trochilidæ:
† Oreotrochilus Chimborazo Bourc.
† " Pichincha Bourc.
* Campylopterus æquatorialis Gould. — Mar- [anon.
Colibri iolatus Gould. — Peru, Bolivia.
Myrtis Fanny Less. — Peru.
Lafresnaya Gayi Bourc. — Peru.
Docimaster ensiferus Boiss. — New Gra- [nada.
" Schliephackei Cab.— Nanegal.
Helianthea Lutetiæ Delatt. — New Gra- [nada.
Pterophanes Temminckii Boiss. — New [Granada.
Aglaeactis cupripennis Bourc. — New Gra- [nada.
Panoplites flavescens Lodd. — New Gra- [nada, Napo.
† Rhamphomicron Herrani Delatt.
" Stanleyi Bourc.
† " microrhynchus Boiss. — [New Granada, Upper Amazon.
† Adelomyia maculata Gould.
Metallura tyrianthina Lodd. — New Gra- [nada, Puna Is.
Lesbia amaryllis Bourc. — New Granada, [Peru, Puna Is.
† " gracilis Gould.
† " Ortoni Lawr.
Aecstrura Hellodori Bourc. — New Gra- [nada.
" Muisanti Bourc. — New Gra- [nada.
Chlorostilbon chrysogaster Bourc. — New [Granada, Pacific slope.
Patagona gigas Vieill. — Peru, Bolivia, [Chile.
† Eriocnemis Luciani Bourc.
† " nigrivestis Bourc.
† " squamata Gould.

Cuculidæ:
Coccygus melanocoryphus Vieill. — Upper [Amazon, Guiana, Paraguay.

Capitonidæ:
* Capito Bourcieri Lafr. — New Granada.
" Hartlaubi Lafr. — New Granada.
† Tetragonops ramphastinus Jard.

Picidæ:
Colaptes elegans Fras. — New Granada.

Strigidæ:
Strix punctatissima Gray. — Galapagos Is.
* Bubo crassirostris P. et L.— Chile.
Glaucidium infuscata Tem. — Brazil, Guat- [emala?
* Speotyto cunicularia Mol. — Brazil, Peru, [Chile.
Syrnium albogulare Cass. — New Granada, [Mexico.

Falconidæ:
† Milvago carunculatus Des Murs.
Polyborus Audubonii Cass. — Texas to Ma- [gellan Sts.
Craxirex unicinctus Tem. — Southern U. [S. to Arg. Repub.
Geranoaetus melanoleucus Vieill. — The [Andes.
Hypotriorchis columbarius Linn. — New [Granada, North America.
Tinnunculus sparverius Linn. — Brazil, [Guiana, North America.
Accipiter erythrocnemius Gray. — Bolivia, [Brazil.
† " nigroplumbeus Lawr.
Circus cinereus Vieill.

Vulturidæ:
Sarcoramphus gryphus Linn. † — Andes.
* Catharista atrata Bartr. — Tropical Amer- [ica, Chili.

† Unless we are much mistaken, there is another species of *Sarcoramphus* on the Andes a yet undescribed. See *Proc. Am. Assoc. Sci.* 1870, p. 194.

Columbidæ:
* Chamæpelia gravativa Bp. — New Gra-[nada.
* Chloroenas albilinea Bp.— New Granada, [Costa Rica.
* Columbula cruziana Lafr.
† Zenaida hypoleuca Bp.
Penelopidæ:
* Ortalida Montagnii Bp.
* Crax (globulosa Spix?) — Upper Amazon.
Chamæpetes Goudatii Less. — New Gra-[nada.
Tinamidæ:
* Rhynchotus perdix Mol.
Charadriidæ:
Vanellus resplendens Tsch. — Peru.
Chionididæ:
†* Attagis Chimborazensis Scl.
Scolopacidæ:
Tringa maculata Vieill.—North America.
* Tringoides macularius Linn. — N. A., Eu-[rope.
* Gambetta melanoleuca Gm. — U. S., Cen-[tral America.
" flavipes Bp.— North America.
Totanus solitarius Aud. — North America.
Gallinago nobilis Scl.
Ardeidæ:
Nyctiardea Gardeni Baird. — U. S. to Peru.
Rallidæ:
Rallus Virginianus Linn.— North America.
* Fulica Chilensis Des Mu.—Peru, Bolivia.
Anatidæ:
* Querquedula discors Linn.— United States.
* Anas moschata Linn.— Brazil.
Colymbidæ:
Podiceps occipitalis Less.— Chili, Magellan [sts.

This list gives one hundred and eighty-four species, of which thirty-eight are believed to be confined to the Valley.* The Insessores number one hundred and sixty-nine, hummers, tanagers and fly-catchers predominating. The one hundred and eighty-four species represent one hundred and twenty-five genera: Southern New England (Mass., Conn. and R. I.) with the same area contains two hundred and forty-two species in one hundred and sixty-three genera; Ceylon, nearly twice as large as the Valley, has over three hundred and twenty species in two hundred genera. The relative proportion is not very different. The majority of the Quito birds have a northern stamp. About eighty species range north of Quito, chiefly in New Granada; of these, twenty-one are found in North America. About twenty-five species range south into Peru, Bolivia and Chile; while very few indeed are found on the Pacific or Brazilian slope. This accords with that "rule of high generality" that the inhabitants of an area are much more nearly related to those of the nearest source whence immigrants might have come. The birds of the Quito Valley have a more extensive latitudinal than horizontal range.

As a general rule the highland species are larger than the same residing in the lower altitudes. Thus, *Buthraupis cucullata*, *Ancestrura Mulsanti* and *Metallura tyrianthina* of Quito are much larger than those of Bogota. So the *Patagona gigas* is larger in Ecuador than in Chile; and the *Chætura rutila* of Quito eclipses the same species in Guatemala. The *Euphonia nigricollis* of Brazil, however, seems to be larger than that of the Andes. The

* Many specimens are reported from Quito which in fact come from Nanegal or the Napo region. Thus, *Andigena laminirostris*, *Bourcieria fulgidigula* and *Peristera mejanoptera* are from the west side, and *Tanagra cælestis* from the east. It is doubtful if either species of *Docimaster* enters far into the Valley. The Trogons and Jacamars are also accidental.

birds of the high Valley are essentially aerial; they show a greater development of wings over legs; climbers, scratchers, runners, waders and swimmers are few. There is less brilliant plumage than in lower, warmer altitudes. Green and brown are the prevailing colors. Even the hummers are surpassed by those on the Pacific slope, in the Valley of the Magdalena and along the coast to Rio. All of the Trochilidæ belong to the group Polytminæ; the "Hermit" hummers keep to the dense forests. Leaving out the *Docimaster* (which properly belong to Nanegal on the west slope), the average length of the bills of Quitonian hummers is three-fourths of an inch. Their nests are covered with moss; never with lichens. The finches nidify in October; the condors in February; the hummers in April.

THE GENUS HYSTERIUM AND SOME OF ITS ALLIES.

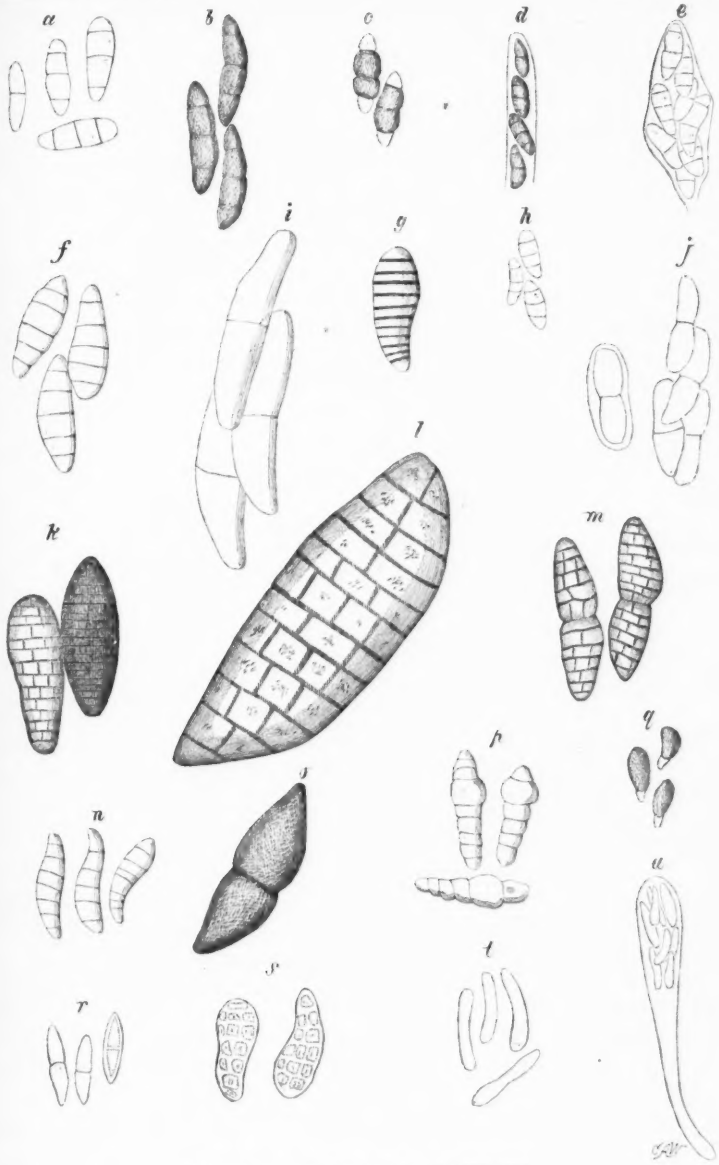
BY DR. J. S. BILLINGS, U.S.A.

My purpose in the following paper is to enable those who are commencing the study of mycology, but who have not access to authentic specimens and to the greatly scattered and often contradictory literature of the subject, to identify the common species of the genus Hysterium and its closely allied forms. My data for this purpose are derived from the examination of authentic specimens in the Schweinitz Herbarium, and in the herbarium of Mr. H. W. Ravenel of South Carolina; from specimens named by Rev. M. A. Curtis, and from the description and figures given by M. Duby in his "Mèmoire sur la Tribu des Hystèrinèes," Geneva, 1861.

The genus Hysterium is one of the Ascomycetous forms of fungi characterized by the peculiar shape and mode of opening of its conceptacle or perithecium,* which is either elliptical or longitudinal, opening by a slit or fissure running in the direction of its greatest length.

The species are found upon dead wood, bark, leaves and stems

*For explanation, with figures, of the parts of fungi, see NATURALIST, vol. iv. p. 667-674.



BILLINGS ON THE GENUS HYSTERIUM.

in the shape of black specks or crusts which, under a lens, will be seen to be small, boat-shaped bodies with a vulvæform fissure looking like minute grains of black wheat. When developed in or on wood, their structure is usually carbonaceous and brittle. When developed beneath the epidermis of leaves or herbaceous stems, the perithecium is usually thin and membranaceous, and more or less connate with the surrounding structures.

The difference in fruit is also well-marked and hence these latter forms will be referred to the genus Hypoderma.

For the identification of the species of this genus in the present state of our knowledge, we must rely mainly upon the size, shape, structure and color of the spores, and hence a few words are necessary with regard to the morphology of the spore. Spores vary according to age and some other circumstances in all the points upon which we rely. Thus the same spore at different periods may be colorless or very dark colored, uniseptate or multiseptate, fusiform or obovate, and from .0005 to .002 of an inch in length.

The limits of this variability are not precisely known, but the student may be guided somewhat by the fact that the development of spores and asci is not everywhere simultaneous in the same perithecium. When in any ascomycete we find the perithecium fully developed, and all the spores apparently equally mature—for instance, all yellow brown, triseptate and varying not greatly in form and size,—we are justified, I think, in concluding that these spores are mature.

If, on the other hand, we find that some of the asci do not contain spores, but merely the mass of greenish colored protoplasm which by segmentation will ultimately form them, while other asci contain greenish spores the contents of which are divided into two or four parts—and in none do we find colored or clearly septate spores—we may consider the specimen as immature.

The peculiar greenish hue of the spore, to which I have alluded, seems to indicate that it is an immature state of a yellow or brown spore, while a white, perfectly colorless or hyaline spore may be in itself a perfect form. In the examination of specimens which have been for some time in an herbarium, we should expect to find the spores mostly mature, as in the first place it is to be presumed that only the more perfect specimens would be thus preserved, and secondly, the perfecting and ripening of immature spores will go on, even in the herbarium, to some extent.

Again it must be remembered that the classification of the genus Hysterium must be as yet provisionary, not being based at all upon the only real test of a true species, *viz.*, the propagation of its kind. But before we can attempt the true physiological classification of such forms, we must have some sort of division of them that we may know what we are talking about. In this point of view it is evident that we want to name as many forms as possible to avoid confusion, and that two different forms should not receive the same name unless the observer is very certain as to their identity. To explain my meaning more fully I will take the case of one of the commonest forms among the Ascomycetes, *viz.*, *Hysterium pulicare* Pers. The description of this species, as given by Persoon, Fries and the older mycologists, is entirely insufficient to enable us to identify it, and we must have recourse to authentic specimens to know positively which form the older authors placed under this head. The spores shown in fig. *a* of plate 11 were drawn from a specimen in the Schweinitz herbarium received from Fries as a type specimen. Another specimen from Fries, marked *B. lenticulare* has the same kind of spores. A specimen from the *Scleromycetes Suiciæ* in Mr. Ravenel's herbarium has somewhat larger spores which are obovate, triseptate and very dark brown. Duby states as the result of the examination of authentic specimens that the spores of *H. pulicare* are oblong, two or three times longer than wide, triseptate, clear brown, or with the terminal loculi colorless. When young the spores are 1-septate and hyaline.

Corda figures the spores in like manner. On the other hand, I find in one specimen named by Kunze, and in specimens named by Berkeley, Curtis and Ravenel, that the spores are much larger, darker, more opake, with longitudinal septa and obovate or pyriform, in short, like the fruit of *H. elongatum*. (Pl. 11, fig. *k*). The authors last named consider the above as belonging to *H. pulicare* for the reason that in one perithecium, resembling those of that species, they find spores varying from the short, colorless, uniseptate form, to those described above. It is of course possible, and perhaps not improbable, that the large cellular spores are the fully developed fruit, but on the principles stated above (as I find in the majority of authentic specimens that all the spores present an equal development and yet have a simpler form), I prefer to consider that form as the perfect type and refer the others to *H. elongatum*.

It will be observed that I have taken no note of the minor differences which the perithecia present.

An examination of many varieties and specimens has shown that in *H. pulicare*, for instance, the perithecia may be long or short, wide or narrow, striate or smooth, with lips thin or thick and more or less gaping, the variations appearing to depend on the kind of wood, the age of the specimen, and the amount of heat, light and moisture to which it has been subject, and hence such characteristics are of little relative value.

It is supposed that besides the ascous form, Hysterium has other modes of manifestation; for instance, Tulasne affirms that *Leptostroma vulgare* is a form of *Hysterium herbarum;* the argument being the usual one of *post hoc ergo propter hoc*, that is, *Hysterium herbarum* has been found either coincident with, or immediately succeeding to the Leptostroma on the same matrix. As I have elsewhere insisted, the only way to settle this question is by culture of the various forms upon different matrices.

The germination of Hysterium spores goes on very well in an ordinary growing slide, and the results are very interesting, especially in regard to those species with cellular spores, in which each loculus gives rise to a mycelial filament. I have several times observed a connection formed between neighboring filaments, resembling very much the sexual process as it occurs in some algæ, but as yet am not prepared to say that it is of a sexual nature. I recommend the subject for observation and experiment to those who have microscopes and no definite work on hand for their instruments.

The best classification of the Hysteriacei is that of M. Duby, but I think he has been premature in his effort to construct half a dozen new genera. The old division of Lophium, Glonium, Actidium and Hysterium serves well enough for identifying purposes, although as stated in the commencement of this paper, those forms of Hysterium, with thin membranous perithecia found in leaves and herbaceous stems, may be conveniently referred to the subgenus Hypoderma.

The data are yet wanting for a revision of this family with a view to indicating their relations to other fungi and to each other.

The accompanying plate gives the figures of the spores of the common forms of Hysteriacei magnified five hundred diameters. Fig. *l* represents a very large spore from a specimen in Mr. Rav-

enel's herbarium, marked *H. depressum* B. and C. Other spores in the same specimen were one-fourth less in size. With these figures and the following brief synopsis, there will be little difficulty, I think, in identifying the usual forms.

HYSTERIUM.

A. Spores simple, colorless, minute (Aporia of Duby).
1. *Hysterium herbarum* Fr. Spores minute, colorless, globose. (Sp. ex. Fr. in Schw. Herb.)

B. Spores filiform, colorless or greenish, lying side by side in bundles, often apparently without an investing sheath or ascus. (Lophodermium, Sporomega, Coccomyces and Colpoma of Duby.)
2. *H. pinastri* Schrad.
3. *H. arundinaceum* Schr.
4. *H. melaleucum* Fr.
5. *H. maculare* Fr.
6. *H. tumidum* Fr.
7. *H. foliicolum* Fr.
8. *H. griseum* Schw.
9. *H. variegatum* B. & C.
10. *H. rhois* Schw.
11. *H. rhododendri* Schw.

A number of additional species are enumerated in this connection by M. Duby, but I give only those which I have examined. The structure and relations of this group are very obscure. Some of them are almost certainly immature or aborted forms, and science would lose nothing if the whole were reduced to *H. arundinaceum* and *H. foliicolum*.

C. Spores simple, colorless, elongate, often curved and sausage-shaped.
12. *H. rubi* Pers. Spores colorless, .0015 inch long. (Fig. 20.) (Spec. ex Kunze in Schw. Herb.)
13. *H. scirpinum* Fr. Spores colorless, .0018 inch long. (Sp. ex Fr. in Schw. Herb.)
14. *H. corni* Schw. Spores rod-like, straight, .002 inch long. (Spec. ex Kunze in Schw. He
15. *H. rufescens* Schw. Spores subfusiform, colorless, .0005 inch long, in long vate asci.

D. Spores uniseptate.
16. *H. smilacis* Schw. Spores colorless, subpyriform, .001–.0013 inch long, with a gelatinous envelope when young. (Fig. 16.) (*H. Curtisii* Duby, is probably the same.)
17. *H. varium* Fr. Spores brown, opake, fusiform, subacuminate, .003 inch long.
18. *H. lineare* Fr. Spores colorless, ovoid or obovate, sometimes constricted in the middle, .0005 inch long.
19. *H. repandum* Blox. Spores at one end elongate and hyaline, the rest dark brown, .0006–.0007 inch long. (Fig. 17.)

E. Spores triseptate.
20. *H. pulicare* Fr. Spores dirty brown, terminal loculi often clearer or colorless, .0009 inch long.
21. *H. betulignum* Schw. Spores brown, .0008 inch long.
22. *H. tortile* Schw. Spores brownish, obovate, .0006 inch long.
23. *H. flexuosum* Schw. In the specimen in the Schweintz Herbarium, the spores in the distinctive flexuose perithecia are identical with those of *H. pulicare*. In some straight short perithecia the spores are cellular, .0015 inch long.
24. *H. biforme* Fr. Spores yellow brown, .001–.0012 inch long, sometimes constricted at the septa or torulose.
25. *H. Prostii* Duby. Spores brownish, subpyriform, .0005 inch long.
26. *H. rufulum* Fr. (Triblidium of Sprengel.) Spores at first reddish brown, afterwards dark, .001–.0014 inch long.

F. Spores multiseptate, or cellular.
27. *H. acuminatum* Fr. Spores curved, yellow, multiseptate, obtuse or subacuminate, .001–.0013 inch long.
28. *H. insidens* Schw. Spores dark yellow brown, 5–7 septate, .0011 inch long; third or fourth joint swollen.
29. *H. Mori* Schw. Spores dark yellow brown, curved, subpyriform, multiseptate, .001–.0013 inch long.
30. *H. teres* Schw. Spores yellow, 3–5 septate, .0008–.0012 inch long.
31. *H. fraxini* Pers. Spores dark brown, elliptic or subpyriform, cellular, .0015 inch long. (Spec. ex Kunze.)
32. *H. prælongum* Schw. Spores yellowish, broadly obovate, cellular, .0012 inch long.
33. *H. vulvatum* Schw. Spores dark, nearly opake, constricted in the middle with distinct septum, .0015–.002 inch long, each half cellular.
34. *H. elongatum* Wulfr. Spores dark brown, obovate or subpyriform, cellular, .001–.002 inch long. (Spec. ex Fries.)
35. *H. depressum* B. & C. Spores dark, opake, brown, cymbiform, cellular, with central distinct septum, like *H. vulvatum*, .003–.0045 inch long. (Spec. in Rav. herb. ex Curt.)

36. H. *decipiens* Duby. Spores straw color, obovate or elliptical, .001 inch long, 4-5 septate, with one or two longitudinal septa.
37. *H. Lesquereuxii* Duby. Spores brownish, ovate oblong, constricted in the middle, obtuse, 6-7 septate, with longitudinal septa.
38. *H. funereum* DeNot. Spores ovoid or oblong, 4-7 locular, with one or two longitudinal septa, four times as long as broad, clear, brownish. (Duby.)
39. *H. complanatum* Duby. Spores linear lanceolate, acute, 3-5 septate, not constricted, reddish brown.
40. *Hysterium verbasci* Schw. Spores colorless, subpyriform, often curved; endochrome multipartite, .001-.0015 inch long.
41. *H. elatinum* Pers. Spores like *H. verbasci*.
42. *H. vimincola* Schw. Spores colorless or greenish, multipartite, obovate, .001 inch long or more.
43. *H. virgultorum* Desm'g. Spores colorless, curved rods indistinctly 4-5 septate, .0005 inch long.

Species which should be rejected as not belonging to the genus, or as having no fruit, and therefore not to be identified:—

H. abbreviatum Schw. Spec. in Schw. Herb. is an immature Sphæria.
H. polygonati Schw. Sp. in Schw. Herb. has no fruit.
H. oxycoccus Fr. Sp. ex Fr. has no fruit. Duby found no fruit in authentic specimens.
H. osmundæ Schw. Sp. in Schw. Herb. is a Septoria.
H. mucicola Schw. " " " " has no fruit.
H. libricola Schw. " " " " is a Hendersonia.
H. kalmiæ Schw. " " " " has no fruit.
H. syringæ Schw. " " " " " " "
H. sphæroides A. S. " " " " ex Fr. no fruit. Duby found no fruit in authentic specimens.
H. castaneæ Schw. Spec. in Schw. Herb. has no fruit.
H. Andromedæ Schw. " " " " " " "

The following species are rejected by Duby.

H. abietinum Pers.
H. parallelum Wahl.
H. rubrum Fr.
H. cocciferum Cast.
H. olew Cast.
H. strineforme Walls.
H. sumæorum Larch.
H. pithyum Kunze.
H. minutum D. C.

DESCRIPTION OF PLATE II.

Fig. *a.* Spores of *Hysterium pulicare* Pers.
" *b.* " " " *biforme* Fr.
" *c.* " " " *teres* Schw.
" *d.* " " " *tortile* Schw.
" *e.* Ascus and spores of *Hysterium flexuosum* Schw.
" *f.* Spores of *Hysterium fraxini* Fr.
" *g.* " " " *mori* Schw.
" *h.* " " " *Prostii* Duby.
" *i.* " " " *chlorinum* B. & C.
" *j.* " " " *smilacis* Schw.
" *k.* " " " *elongatum* Fr.
" *l.* " " " *depressum* B. & C.
" *m.* " " " *vulcatum* Schw.
" *n.* " " " *acuminatum* Fr.
" *o.* " " " *varium* Fr.
" *p.* " " " *insidens* Schw.
" *q.* " " " *repandum* Blox.
" *r.* " " " (*glonium*) *graphicum* Fr.
" *s.* " " " *verbasci* Schw.
" *t.* " " " *rubi* Fr.
" *u.* " " " *rufescens* Schw.

SOME DIFFERENCES BETWEEN WESTERN AND EASTERN BIRDS.

BY T. MARTIN TRIPPE.

When the primitive prairie becomes reclaimed from a state of nature by the pioneer and farmer, the fauna and flora undergo a very marked change. Many plants and animals disappear, and new ones take their places. The buffalo, elk and antelope retire before the advancing line of civilization, and are seldom found within the settlement; the deer, wolf and turkey gradually disappear as the country becomes populated, and are finally exterminated. Many species of Compositæ and other plants, found in great profusion on the unbroken prairie, become scarcer and scarcer, as the sod is broken up and cultivated, and at last disappear altogether. With the birds, the changes are rapid and numerous; some species are quickly exterminated, and others previously unknown, become abundant. So rapid is the progress of settlement in some portions of the west, that these changes become very marked from their suddenness. Local lists of the avi-fauna of eastern Iowa and Minnesota, taken twelve or fifteen years ago, would differ very materially from those of the same localities to-day; and these lists would differ both in the species, and in their comparative and actual abundance. Even the habits of the birds undergo considerable modification, as it will appear in the following pages.

Every one in the Eastern States is familiar with the song sparrow, that little brown minstrel that comes even before the blue-bird to tell us that spring is at hand. He is our earliest bird; a sort of ambassador from the feathered court, sent on by those princes royal of song, the thrushes and grosbeaks, to herald their approach. On some bright sunny day in February, when the chill of the air is somewhat softened by the returning sun, and the woods are vocal with the cry of the downy woodpecker, you hear him first,—a brisk, ringing strain, full of joy and hope, that speaks of warm days to come, and whispers promises of violets and anemones. If you wish for a nearer acquaintance, he is not a bit afraid, but sings as unconcernedly, although you may be watching him a few yards off, as though you were a mile away. In fact, he is semi-

domestic in the early days of his coming, and hovers about the house and garden, tame and familiar, a willing dependent upon your bounty, picking up the crumbs about the door-steps, and repaying you a thousand fold, every morning and evening; and, having taken up his abode with you, he likes it well enough to stay all spring, summer, and fall, always the same, cheerful, familiar and musical.

Very different, indeed, is the song sparrow of the transmissisippi states. In March, the ornithologist who rambles over the prairies and along the wooded water-courses of southern Iowa, notices a small, brown bird, flitting among the hazel copses, shy, restless and timid, eluding his observation so carefully, that, if he is unaware of its nature, he will frequently be obliged to shoot it before he can identify it. Then to his surprise, he finds it to be the song sparrow. For a few weeks, he meets in his daily walks, the same shy apparition, though never very frequently, until in April it disappears. Perhaps, once or twice, on an unusually lovely morning, he may catch the familiar song that used to delight him in early March amid the hills of New England; but to hear it even once he must be very fortunate. During summer he may rarely meet the bird in the thickets on the edge of the timber, or even catch him, towards the approach of autumn, reconnoitring in some garden; but only rarely, — until in September and October, they come back again in greatly increased numbers, more tame and familiar than in the spring, and now he begins to recognize some resemblance to the song sparrow of the Eastern States.

Where have they been all summer? In Minnesota — the greater part of them at least. The brush prairies, the thicket in the river valleys, and the shrubbery that surrounds the lakes of western and central Minnesota, are the summer resort of the song sparrow. Here, hundreds build their nests and raise their young, — shy and timid as ever, but no longer silent. The ornithologist just from the east, is astonished to find in the song sparrow, the wildness that marks the meadow-lark and flicker, in New York or Massachusetts, although the notes and habits are otherwise precisely similar.

Yet it takes only a short time for the song sparrow to find out that he has nothing to fear from men, but that on the contrary, it is safer and pleasanter to live in their company than without it. When a region has been settled for a few years, small birds of all

kinds begin to increase in a very marked degree. In the older settlements in Minnesota the song sparrow has already taken up his abode, and though something of his original shyness remains, yet it is rapidly wearing off, and he is becoming the same familiar, confiding bird as in the east. As we progress toward the frontiers, we find him becoming shyer and wilder, till in the wilderness he exhibits almost the wildness and timidity of a wild-duck.

What has been said of the song sparrow, is equally true of the bluebird and robin. In Iowa, some of these birds breed in the timber near the streams, but the greater number pass quickly over the prairies, and find more congenial haunts amid the woods of central and northern Minnesota. The pine barrens seem exactly suited to the robin; here he raises his brood undisturbed; and, amid the dead and decaying poplars and tamaracks that cover miles upon miles of the surface of northern Minnesota, the bluebird nests in great numbers. But very different are they from the robin and bluebird of the east. They fly from your approach afar off; they shun you as the hawk and crow do in New England; and though they have the appearance and voice of old friends, you cannot help feeling that they are old friends become estranged. But as the country becomes settled, like the song sparrow, they soon perceive the advantage of dwelling in civilized society, and are not slow in acting upon it. In some portions of Iowa and Minnesota, these three birds are as domestic as in New York or Pennsylvania.

Thus, the robin, bluebird, song sparrow, and some others of our birds, before the prairies were settled, passed the breeding season in the northern woods of Michigan, Wisconsin and Minnesota; but as the wilderness becomes civilized, and groves of trees are planted upon the prairie, they take up their abode among the habitations of men, and become residents of regions, where before they were merely transient visitors.

But if some birds are more timid in the newly settled parts of the prairies, with others it is precisely the reverse. In the town in which I write — a city of five or six thousand inhabitants of southern Iowa, — blue jays are as common in the trees lining the streets as vireos among the elms of New Haven; crow blackbirds breed as familiarly in the gardens as chipping sparrows; while at almost any hour of the day, wild pigeons and doves may be seen gleaning in the busiest streets. On the upper Mississippi, near

St. Cloud, I have seen crows so tame that I walked within thirty feet of them with a gun on my shoulder, without alarming them in the least. The meadow-lark is as tame as the bluebird in the east, and sings familiarly from the roofs of houses in the villages, and the marbled godwit will let you walk up within twenty or thirty yards without seeming aware of your presence. In the woods of Minnesota, far beyond the settlements, I have found hawks, *Buteo borealis* and *Falco sparverius*, scarcely more concerned at my presence within fifty feet, than the robin or bluebird in the Eastern States. But birds are quick to learn; the mallard and the prairie hen soon discover that it is dangerous to let a man approach within fifty yards, while the wild goose is very discriminating as to the range of buck-shot and rifle-bullet. It is surprising to see how soon birds learn this lesson. I knew a certain cornfield situated at the edge of a large wood in a recently settled part of Minnesota. Here the blue jays from all the country round were wont to forage, coming in scores every morning and evening. Undisturbed at first, they grew so bold as to remain quietly at work within twenty or thirty feet of a passer-by; till finding that they were destroying a considerable portion of his crop, the farmer commenced shooting them, killing them by the dozen for the first few days. In two weeks, the blue jays were so wild when in that field, that it was difficult to get within gunshot of them; while in the woods, half a mile away, they were as tame as ever; and while before they were very noisy and garrulous when in the cornfield, now they never uttered a sound from the time they entered it till they left it again. It took the blue jays only a fortnight to comprehend the situation.

It is easy to see why some birds, as the hawk and crow, should be tamer in the frontier settlements than in the older parts of the country. Not being hunted as game and having few or no enemies, it is not strange that they should have the boldness and confidence which is the result of a sense of security and freedom from danger. On the other hand, it is equally apparent that such small birds as the sparrows, thrushes and finches, continually persecuted by their natural enemies, should learn to be distrustful, and shun the approach of everything from which danger might be apprehended. But in course of time, the larger birds being destroyed as pests or for amusement become, in time, shy and suspicious; while the smaller, protected in a degree and less subject to the attacks of their former enemies, grow tame and familiar.

Some birds, however, seem but little affected by the settlement of the country. The baywinged bunting, for instance, is scarcely more abundant in eastern Iowa than on the unbroken prairies in the western part of the state, nor are his habits different. The greater number breed among the pines of Minnesota, very few remaining in any part of Iowa during summer.

Some species increase rapidly on the first settlement of the country, and then decrease again. Of this class are the prairie hen and mallard. They find abundance of food in the corn and wheat fields; while the population is sparse and larger game so abundant, they are hunted very little; but as the population increases, they are gradually thinned out and become in some cases exterminated. Other birds, as the quail, are wholly unknown beyond the frontier; and only appear after the country has been settled a short time. Still others, woodland species, appear in regions where they were never known before, as groves of trees are planted, and thick woods spring up on the prairies, as soon as the ravages of the fires are checked. Thus, some species are introduced and some exterminated by the settlement of the country, while the numbers of almost all are more or less affected.

The same changes have taken place in the Eastern States, and are still going on there, but so slowly as to be imperceptible. Here in Iowa, on the contrary, they are so rapid as to attract the attention of the most careless observer.

The breeding habits of birds undergo considerable modification on the settlement of the country. In the wilds of Minnesota, I never saw the nest of the robin elsewhere than in the tops of the tallest Norway pines. The crow, in similar localities, often builds on low bushes. The chipping sparrow nests in the same places, and in company with the grass finch. The chimney swallow breeds in hollow trees; the wrens in the decaying trees in the windfalls. The larger birds, hawks and crows, take but little pains to conceal their nests. So far as my observations went, I think that the robin, bluebird and some other small birds, breed a little later in the season than in the settled regions, though I may be mistaken.

The real influence of man upon animals and especially on birds is scarcely yet appreciated. When the subject comes to be more thoroughly understood we shall find that not only are they governed in their range and numbers through his agency, but that even their natures and mental characteristics are changed as well.

REVIEWS.

THE GEOLOGY OF WYOMING.* — The first part contains a geological itinerary, while the second part is more general in its nature, containing chapters giving a general view of the geology of the Missouri Valley, of the region between Omaha and Cheyenne, the route over the first range, the Laramie Plains and westward to Bear River, and onward to the Great Salt Lake Valley, closing with a chapter giving a general review of the geology of the country from Omaha to Salt Lake Valley, and a final chapter on the mines, etc.

Prof. Hayden's explorations are extended over an immense extent of country, and while the work is our only authoritative guide to the geological and agricultural capabilities of this important area, even these preliminary reports throw a flood of light on the geological history not only of the American Continent, but we may venture to add that of the globe and the succession of life on its surface. In illustration we quote as follows: —

"That there is a connection between all the coal beds of the far West I firmly believe, and I am convinced that in due time that relation will be worked out and the links in the chain of evidence joined together. That some of the older beds may be of upper Cretaceous age I am prepared to believe, yet until much clearer light is thrown upon their origin than any we have yet secured, I shall regard them as belonging to my transition series or beds of passage between the true Cretaceous and the Tertiary.

When the large collections of fossil plants from the West now in the possession of Dr. Newberry are carefully studied, we shall have a much better basis upon which to rest a conclusion. It will be seen at once that one of the most important problems in the geology of the West awaits solution, in detecting, without a doubt, the age of the coal series of the West, and the exact line of demarcation between the Cretaceous and Tertiary periods.

The study of this question shows the importance of the continued accumulation of facts and the collection of organic remains. Neither can we place too rigid reliance on the teachings of the fossils, for it has already been shown many times that the fauna

* Preliminary Report of the U. S. Geological Survey of Wyoming, and portions of contiguous territories (being a second annual report of progress). By F. V. Hayden, U. S. Geologist. Washington, 1871. 8vo, pp. 511.

and flora of the Tertiary deposits of this country, when compared with those of the Old World, reach back one epoch into the past. We have already obliterated the chasm between the Permian and the Carboniferous era, and shown that there is a well-marked inosculation of organic forms — those of supposed Permian affinities passing down into well-known Carboniferous strata, and admitted Carboniferous types passing up into the Permian. We believe that the careful study of these transition beds is destined to obliterate the chasm between the Cretaceous and Tertiary periods, and that there is a passing down into the Cretaceous period of Tertiary forms, and an extending upward into the Tertiary of those of Cretaceous affinities. It appears also, that every distinct fauna or flora of a period ought to contain within itself the evidence of its own age or time of existence, with certain prophetic features which reach forward to the epoch about to follow. If there is a strict uniformity in all the operations of nature when taken in the aggregate, as I believe there is, then this is simply in accordance with the law of progress which in the case of the physical changes wrought out in the geological history of the world has operated so slowly that infinite ages have been required to produce any perceptible change. The position that I have taken, in all my studies in the West, is that all evidences of sudden or paroxysmal movements have been local and are to be investigated as such, and have had no influence on the great extended movements which I have regarded as general, uniform and slow, and the results of which have given to the West its present configuration. The splendid group of fossils obtained on the Upper Missouri, from the Fox Hills Group or upper Cretaceous beds, illustrates the prophetic element I have mentioned above. Among them are many true Cretaceous forms, as *Ammonites*, *Baculites*, *Inoceramus*, etc., yet these all present such a modern facies that they seem plainly to look forward into the succeeding epoch, which in the case of our Atlantic coast was strictly marine. It was no fault of the fossils themselves that they were mistaken in this instance."

Prof. Hayden's remarks on the relation of the Quaternary period to the Tertiary are of much interest: —

"As we have previously remarked, we believe that the Quaternary period, although more difficult to study, will be found to be scarcely second in importance to any of the previous great epochs in geology. A careful study of these modern deposits will undoubtedly show consecutive links by which it was united to the Tertiary period, in the same manner as the Cretaceous and Tertiary are connected in the case of the great Tertiary lake now indicated by the deposits on White and Niobrara Rivers, in Nebraska, in which the waters continued to cover a greater or less area through most of the Quaternary period, at least, as is shown by the thick

deposits of fine sand, with bones of mammals and shells of existing species, on Loup Fork and its tributaries. The same may be said of the bluff deposit, or loess, which is so well displayed along the Missouri from Fort Pierre down below St. Louis, and probably, to the Gulf of Mexico. At a modern period it is probable, that the waters of the ocean swept high up inland, reaching nearly to the foot of the mountains. The great water-courses had already been marked out, consequently we find the yellow marl or loess fifty to one hundred and fifty feet thick in the immediate valley of the Missouri, but thinning out as we recede from it, or the valleys of any of its branches. The existence of so many fresh-water mollusca and the entire absence of any marine forms indicate that the waters of the Mississippi and Missouri were either cut off from the direct access to the sea, or that the influx of such a vast quantity of fresh water as must have flowed down from the mountain districts rendered completely fresh the inland portions.

We may suppose the temperature just prior to the present period to have been extremely low, and that the elevated portions of the West were covered with vast masses of snow and ice; that as the temperature became warmer this snow and ice melted, producing such an accession to the already existing waters that they covered all the country excepting, perhaps, the summits of the highest peaks; that masses of ice filled with fragments of rocks, worn and unworn, floated off into this great sea, and melting, scattered the contents over the hills and plains below; that as the waters diminished these masses of ice would accumulate on the summits of the foot-hills of the mountains, or at certain localities in the plains; and thus account for the great local accumulations of stray rocks at certain places. The materials also which must have been removed from all portions of the West drained by the Missouri and its tributaries by surface denudation, as is illustrated by the "bad lands", etc., were also swept into this vast inland lake, and then carried beyond the reach of currents, would settle quietly to the bottom, almost without lines of stratification, as we observe in the loess. The last act was the recession of these waters to their present position, and the formation of the terraces. We believe the terraces constitute the last change of any importance in the surface of the western continent. We suppose that the channels of all the streams on the eastern slope of the Rocky Mountains were at one time occupied with water from hill to hill, and that the drainage was toward the sea. But in the Great Basin, which so far as we know has no outlet, the drainage must have been by evaporation, for the evidence points to the conclusion that it was entirely filled with water high up on the sides of the mountains. There is greater uniformity in the terraces in the Great Basin than in the valley of the Missouri, which indicates a far more equable drainage. Still, those along the flanks of the Wasatch Mountains number two or three principal ones, but these

formations separate into five or six; and Stansbury mentions one locality where there are ten or twelve of them. In the Missouri Valley and along the eastern slope generally, the terraces vary much in height and importance.

The distant hills are composed of the yellow marl or loess, and the surface has been weathered into the rounded, conical hills. This portion is often covered with the drift or stray rocks, or what I have called in a former report the erratic block deposit. On the terraces these erratic masses are scarcely ever found, and in the broad bottoms of the Missouri River seldom if ever. This fact strengthens the opinion that the terraces are really one of the latest features, and that they were formed during the drainage of the waters toward the sea after the temperature had reached nearly its present state. Oscillations of level may have contributed somewhat to the formation of the terraces, but I am inclined to believe that the drainage or the contraction of the waters is the main cause. This is an important point, and I hope hereafter to treat it more fully when I have accumulated a greater number of facts. It has been my belief for years, that not only the Missouri River but all the branches, from the largest river like the Yellowstone or Platte that flowed into it to the smallest creek that has cut its cañon deep into the sides of the mountains, were once filled with water from side to side, but have gradually shrunk to their present diminutive proportions. All over the West are large dry beds which must have at one time given passage to vast bodies of water. The flanks of the mountains, from the north line to Mexico are gashed with gullies or cañons, many of which are now dry as the dusty road for the greater portion of the year. I mention some of these details here simply to show how closely the story of the physical growth of our western continent is linked together, and that it needs only the careful, conscientious grouping together of the facts to secure this history step by step from the earliest commencement to the present time, and mould it into one harmonious whole."

Any one with geological proclivities about to take a trip across the continent over the Pacific Railroad should by all means read this interesting sketch of the country between Omaha and Salt Lake.

The third part contains a report by Prof. C. Thomas on the agriculture of the Territory, with notes on the grasshoppers, especially the Western Locust (*Caloptenus spretus.*)

Part IV. contains a preliminary paleontological report by Prof. F. B. Meek, with reports on the Tertiary coals of the West, by James T. Hodge; on the ancient lakes of Western America, their deposits and drainage, by Prof. J. S. Newberry (which will be

found at p. 641 vol. IV of this journal); on the vertebrate fossils of the Tertiary formations of the West, by Prof. J. Leidy; on the fossil plants of the Cretaceous and Tertiary formations of Kansas and Nebraska, by L. Lesquereux; on the fossil reptiles and fishes of the Cretaceous rocks of Kansas, the fossil fishes of the Green River group and the recent reptiles and fishes obtained by the naturalists of the Expedition, by Prof. E. D. Cope; and finally, a report on the Industrial Resources of Western Kansas and Eastern Colorado, by R. S. Elliott.

These reports contain matter of much general interest by the distinguished scientists whom Prof. Hayden has summoned to his aid, and give the volume a lasting value. From Mr. Lesquereux's report we select the following remarks on the discordance in the characters of the European and American flora of the Tertiary and Cretaceous epochs:—

"Since the first appearance of land vegetation upon the surface of our earth, what we know of it by fossil remains seems to indicate for our country a precedence in time in the development of botanical types. Large trunks of coniferous wood are already found in our Devonian measures, while analogous species are recorded as yet only in the Carboniferous measures of England. Though the analogy of vegetation between the flora of the coal measures of America and Europe is evidently established by a number of identical genera and species, we have nevertheless some types like the *Paleoxiris*, which are considered as characteristic of strata of the European Permian, and which are found in our coal measures as far down as the first coal above the millstone grit. Even peculiar ferns of our upper coal strata have a typical analogy with species of the Oölite of England. Our Trias, by the presence of numerous Cycadeæ, touches the Jurassic of Europe. But it is especially from our flora of the lower Cretaceous that we have a vegetable exposition peculiarly at variance with that of Europe at the same epoch and whose types so much resemble those of the European Tertiary that the evidence of the age of the formation, where the plants have been found, could not be admitted by paleontologists until after irrefutable proofs of it had been obtained."

Prof. Cope's report gives glimpses of the reptilian life which formerly flourished over this region:—

"The species of reptiles which have been found in the Cretaceous strata west of the Mississippi River up to the present time number fourteen. Five of these pertain to the *Sauropterygia*, one to the *Dinosauria*, and seven to the *Pythonomorpha*. In the present report attention is confined to the species discovered near the line

of exploration of Dr. Hayden, or that of the Kansas Pacific Railroad, and that of Professor B. F. Mudge of the State Agricultural College.

During the period when the Cretaceous ocean extended from Eastern Kansas over the present site of the Rocky Mountains, and from the Gulf of Mexico to the Arctic Sea, it abounded in life. Among vertebrata, fishes and marine reptiles chiefly abounded, and in varied forms. Many of the reptiles were characterized by a size and strength exceeding that seen in any other period of the world's history. The species of *Sauropterygia* and *Pythonomorpha* were all aquatic, but the two types present very different adaptations to their mode of life. While the former possessed two pairs of limbs the latter appear to have possessed an anterior pair only, or with the posterior pair so reduced as to have been insignificant. They substituted for them an immensely long and flattened tail, which they used, like the eels and sea-snakes, as an oar. The *Sauropterygia* were generally stout-bodied and with a very markedly distinct neck. In the *Pythonomorpha*, on the other hand, the body was snake-like, with narrow chest and neck scarcely differing in diameter. They were immensely elongate, and might be called sea-serpents with considerable propriety.

Of *Sauropterygia*, *Polycotylus* had a slender neck and very stout limbs; but in *Elasmosaurus* the neck attained dimensions exceeding that of any vertebrated animal. The species *E. platyurus* was probably the longest of the order, measuring perhaps fifty feet, but of this the neck amounted to twenty-two feet. The creature was carnivorous, and could no doubt like the snake-bird, swim at a considerable distance below the surface of the water and reach to the surface for air, or explore the depths or plunge for fishes to the depth of forty feet.

Among the *Pythonomorpha* the *Liodon dyspelor* is the largest species and the *Clidastes intermedius* the smallest. A specimen of *Mosasaurus Missuriensis* obtained by William Webb near Topeka is stated by him to measure seventy-five feet in length. Should this be substantiated the *L. dyspelor* was at least one-third larger. This is, however, as yet uncertain.

The upper arm bones of the Clidastes are remarkably short and wide and furnished with strong processes for the insertion of muscles. They are among reptiles much like those of moles among quadrupeds, and, as in the latter, indicate probably great power of propulsion in the fore limbs. The finger bones were long and slender and formed a long fin or flipper, while the upper arm was probably concealed in the skin. The whole limb came off but a short distance posterior to the head. These reptiles, so far as known were all carnivorous; their food was chiefly fishes."

His notes on the fossil fishes are of much interest: —

"The laminated rock from which the above species were ob-

tained is similar in general appearance to the clay beds of Mount Lebanon and Mount Bolca. The first indication of the existence of this deposit was brought by Dr. Jno. Evans, who obtained from it a clupeoid, which was described by Dr. Leidy as *Clupea humilis* (Proc. Acad. Nat. Sci. Phila., 1856, p. 256). One of the blocks contains the remains of two shoals of the fry, probably of *C. humilis*, which were caught suddenly by a slide or fall of calcareous mud, and entombed for the observation of future students. They must have been taken unawares, since they lie with their heads all in one direction as they swam in close bodies. One or two may have had a moment's warning of the catastrophe, as they have turned a little aside, but they are the exceptions. The fry are from one-half to three-quarters of an inch long and upward.

True herring, or those with teeth, are chiefly marine, but they run into fresh waters and deposit their spawn in the spring of the year, and then return to salt waters. The young run down to the sea in autumn and remain there till old enough to spawn. The size of the fry of the Rocky Mountain herring indicates that they had not long left the spawning ground, while the abundance of adults suggests they were not far from salt water, their native element. To believe, then, that the locality from which these specimens were taken was neither far from fresh, nor far from salt waters is reasonable; and this points to a tide, or brackish inlet or river. The species of *Cyprinodontidæ* inhabit also tide and brackish waters. Most of the species of the family as well as of the genus, are inhabitants of fresh water; but they generally, especially the cyprinodons proper, prefer still and muddy localities, and often occur in water really salt. This habitat distinguishes them especially from Cyprinidæ (minnows and suckers) and pike. Lastly, the known species of Osteoglossum inhabit fresh waters.

The material which composes the shales indicates quiet water, and not such as is usually selected by herring for spawning in; while the abundance of adult Clupeas indicate the proximity of salt water.

This is far from a satisfactory demonstration of the nature of the water which deposited this mass of shales, but is the best that can be obtained with such a meager representation of species.

As to geological age the indications are rather more satisfactory. The genus Clupea ranges from the Upper Eocene upward, being abundant in the slates of Lebanon and Monte Bolca, while Cyprinodon has been found in neither, but first appears in the middle or lower Miocene in Europe. The Asineops resemble very closely, and I believe essentially the Pygæus of Agassiz of Eocene age, from Monte Bolca. The peculiarities presented by the genus found by Dr. Hayden are of such small significance as to lead me to doubt the beds in question being of later than Eocene age, though the evidence rests chiefly on this single, new and peculiar genus.

The position of these fishes, seven thousand feet above the level of the sea, furnishes another illustration of the extent of elevations of regions once connected with the ocean, and the comparatively late period of geologic time at which, in this case, this elevation took place."

If we find so much of interest and novelty in the preliminary report, how much has our science in store when the final report and its illustrations appear!

Geographical Distribution of the Beetles.* — In this exceedingly interesting and suggestive essay, the author divides the Coleoptera of the world into three great "stirps," or assemblages: — the Indo-African, the Brazilian, and what for want of a better name he calls the "microtypal" stirps; the species composing it "being of a smaller size, or, more strictly speaking, not containing such large or conspicuous insects as the others." Thus all but the tropical, even including the Australian insects, are considered as belonging to this mass of small forms. "The coleopterous fauna of our own land [Great Britain] may be taken as its type and standard."

We very much question whether this division be not too artificial to be generally received by zoologists. The primary distribution of faunæ corresponding to the polar, temperate and tropical regions, would seem to be the more philosophical, being based on climatic causes.

Mr. Murray believes that the diffusion of animals and plants by accidental means "bears no important part in the establishment of any definite fauna or flora." He thinks that actual continuity of soil and subsequent isolation alone produce faunæ with a definite character. While he thinks these changes of surface took place before the Tertiary period, and does not believe that the new Atlantis, to take a case in point, existed during that period, yet he is one of the most ultra in the school of writers on geographical distribution who take up and put down continents like checkermen. Thus the Azores, Canary Islands and St. Helena, Ascension Island, St. Paul and Tristan d'Acunha, are to Mr. Murray the relics of a former continent, when the Atlantic was dry land, and Europe and America ocean beds. He puts down a

*On the Geographical Relations of the Chief Coleopterous Faunæ. By Andrew Murray. Extracted from the Linnæan Society's Journal.—Zoology, vol. XI, London, 1871. 8vo. pp. 89.

"stretch of dry land" between Old Calabar, Africa and Brazil, and again another "continental route of communication" between Patagonia and the Cape of Good Hope "and which, last of all and probably not without relation to the preceding, united Brazil and Madagascar." Now it seems to us this is in direct violation of one of the best founded and grandest laws in physical geography, as brought out by Professor Dana. He has shown that the present continents of the globe, were each built up around a Laurentian nucleus, and have gradually extended to their present dimensions, being originally islands or archipelagoes, and that the present ocean beds have never been dry land; the borders of the continents within the line of a hundred fathoms more or less, often involving thousands of square miles, oscillating above or below the ocean level, but with no intercontinental bridges. It seems to us that this law goes hand in hand with the climatic laws regulating the distribution of the faunæ of the earth, and that the writer of the essay before us has, in a measure, violated both at the outset.

Space does not permit us to notice the many new and extremely interesting points brought out by Mr. Murray in reference to the smaller faunæ, except to briefly give his remarks on our own fauna. We think that what we quote will show that while a great mass of facts are given, the author's broadest generalizations will not meet with general acceptance. Thus he labors to show that the fauna of Australia is much like that of Europe and North America, both being "microtypal," namely, having small species. By the same mode of reasoning an Esquimaux does not differ from an Australian, as both are not gigantic in stature, and hence both belong to the same primary fauna. He remarks, "North America has no special fauna or flora of its own. That which it has is a mixture of the microtypal and Brazilian stirps intermingled with fresh importations of different dates, and modified by the advance and retreat of the glacial epoch; but, on the whole, the preponderating element in its fauna is the microtypal." The similarity of the Californian fauna to that of Asia is accounted for by a "former communication having existed between Asia and California."

As to the European fauna and flora being the type of the "microtypal" fauna, we wonder what would have been considered the standard, if modern science had developed first in Japan or Australia, rather than Europe? Is the flora of North Temperate Amer-

ica any more European, than is that of northern Europe, North Temperate American? This is a species of anthropomorphism in science that we are disposed to distrust, as facts of distribution of life in palæozoic times, as Mr. Murray acknowledges, tend to show that the Silurian continental nucleus of Europe was not indebted to that of North America for its fauna, or *vice versa;* and in all probability there has been no interchange of forms between the Arctic and Antarctic lands. Do not the known facts in geographical distribution tend to show that the different continental nuclei have been from the first, distinct centres of distribution and evolution for the larger proportion of animals and plants, which may have evolved from ancestral forms, at the outset restricted to separate ocean beds, and separate continents?

The Brachiopoda of the Coast Survey Expedition.*—In this valuable contribution to our knowledge of the Brachiopods, Mr. Dall instead of being content with giving a synonymical list of the species, with descriptions, enters as thoroughly as his material would allow into the anatomy of these animals. He also enumerates the characters of the class, and the two orders in which it is divided. As a striking feature in the anatomy of *Terebratula Cubensis* he also notes "the absence of that great series of sinuses in the anterior part of the mantle, which was termed by Hancock 'the great pallial sinuses.'" The illustrations are excellent.

Sea Side Studies in Natural History.†—A second edition of this useful book has appeared. As a preparatory note states, it is a mere reprint of the first edition, with a few verbal changes. A brief notice of the recent deep sea explorations is added.

Catalogue of European Lepidoptera.‡—A catalogue of European butterflies and moths is of great use to the American student, and we are glad to see an enlarged and revised edition of the present work, the only available catalogue we have.

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*Report on the Brachiopoda obtained by the U. S. Coast Survey Expedition in charge of L. F. de Pourtalès, with a revision of the Craniidæ and Discinidæ, by W. H. Dall. Bulletin of the Museum of Comp. Zoology, Vol. 3. No. 1 with 2 plates. Cambridge, May 1871. 8vo. pp. 45.

†Sea side Studies in Natural History, by Elizabeth C. Agassiz and Alexander Agassiz. Marine Animals of Massachusetts Bay. Radiates. Boston. J. R. Osgood & Co. 1871. 8vo pp. 157, with 186 wood cuts.

‡Catalog der Lepidopteren des Europæischen Faunengebiets; I, Macrolepidoptera, bearbeitet von Dr. O. Staudinger; II, Microlepidoptera, bearbeitet von Dr. M. Wocke, Dresden, 1871. 8vo. pp. 426.

The Early Stages of Brachiopods. * — The final memoir on this subject, of which an abstract by the author is given on p. 385 vol. iii., of this journal, has at length appeared. After describing the different stages of *Terebratulina septentrionalis*, which are figured with many details on two excellent plates, Prof. Morse discusses the relations of Brachiopods with the Polyzoa, and in closing remarks as follows: —

"With propriety may also be suggested a certain parallelism between the leading groups of the Polyzoa and the Brachiopods. We have forms like Lepralia, attached by one region of their shell, this shell being calcareous and exhibiting minute punctures, which have been compared to similar markings in certain Brachiopods. So among the latter group do we find forms attached, as in Thecidium, and some species of Productus; and generally the articulate Brachiopods might be compared to such forms as Lepralia, while on the other hand, such genera as Pedicellina, with its long, pliant and muscular stalk, or Loxosoma, with a stalk highly retractile, may be compared to Lingula. The limits or intentions of this paper will not allow any considerations regarding the relations of the Brachiopods with the other groups of the animal kingdom. I have elsewhere expressed my belief that they are true articulates, having nearer affinities with the Vermes; and in view of the above relations of the Brachiopods with the Polyzoa, it is interesting to remark that Leuckart has for a long time placed the Polyzoa with the Vermes, and in a new edition of the 'Outlines of Comparative Anatomy' Professor Carl Gegenbaur removes the Polyzoa from the Mollusca, and associates them with the Vermes."

NATURAL HISTORY MISCELLANY.

BOTANY.

Cross Fertilization of Plants. — Mr. Meehan exhibited some flowers of the common *Bouvardia leiantha* of the green-houses, and of the hardy *Deutzia gracilis*, and referred to his papers, published a few years ago in the "Proceedings of the Academy," on practical diœcism in the trailing arbutus (*Epigœa repens*) and

*On the early stages of Terebratulina septentrionalis. By Edward S. Morse, Ph. D (From the memoirs of the Boston Society of Natural History). Boston, 1871. 4to. pp. 10. With two plates.

Mitchella repens, in which he pointed out that these plants, though apparently hermaphrodite, had the stamens and pistils of different characters in separate plants, and were therefore subject to the laws of cross-fertilization as indicated by Darwin. He had had his attention called to the Bouvardia, by Mr. Tatnall of Wilmington, Del., as furnishing a similar instance to that of Epigæa and Mitchella, belonging to the same natural order in which the Cinchoneous division of the Rubiaceæ, Bouvardia, was placed. These had some plants with the pistils exserted, while in others only the stamens were visible at the mouth of the corolla tube. Mr. Tatnall had not had the matter suggested to him early enough to say that it was so in all cases; but he believed that these flowers, which practically might be termed pistillate and staminate, were found entirely on separate plants. This is a very important fact, as Bouvardia is not raised from seeds in green-houses, but from cuttings of the roots, and therefore, all these plants with separate sexes must have been produced from one original individual, without the *intervention of seed*, and thus confirm the position advanced in a previous paper on "bud variations," namely, that variations in form, and, by logical inference, new species, may arise without seminal intervention; and that in this way identical species may appear in separated localities without the necessity of supposing an emigration from one small point, as Darwinism now does.

In the specimens of *Deutzia gracilis* were two forms of flowers on the same plant. Besides the large ones with stamens and pistils apparently perfect as generally seen, there were numerous small flowers in which the petals were only partially developed. The filaments were entirely wanting, but the anthers were as perfect, if not larger than in what we should call the perfect flowers. Any one could see that these small flowers were the result of deficient nutriment, and would be apt to pass the matter over with this simple reflection; but he wished to emphasize the fact that this defective nutrition rendered the female organs inoperative, while the male organs were still able to exercise their functions; thus affording another instance, if any more be needed, of the truth of his theory of sex, namely, that with defective nutrition, the female sex is the first to disappear; and that only under the highest conditions of vitality is the female sex formed.

In the case of the *Bouvardia* a similar law was seen. The

most vigorous stems, or, as they would be technically called, woody axes, produced the female flowers.

WOLFFIA BRAZILIENSIS IN MICHIGAN. — On June 25, 1871, I found the *Wolffia Braziliensis* Wedd. var. *borealis*, in the River Rouge, a tributary of the Detroit emptying a few miles below our city. The little plants grew rather sparingly with *W. Columbiana* Karsten, and *Lemna polyrrhiza* L. Though the *W. Columbiana*, in general its associate, has been found in the east, the *W. Braziliensis* has not, I believe, been met with there. For those not acquainted with it, I will state that it is easily distinguished from the former, even with the unassisted eye, by its subacute, oblong fronds, bright green and shining above, and pale beneath. It is further distinguished by being contracted or somewhat concave above, denser and less cellulose, by its more numerous stomata, and by being marked more or less with brown dots. It is also not so much submerged as the *W. Columbiana*, but floats on the surface of the water, the intensely green upper part lifted quite above it, bearing some resemblance to a little boat. Some botanists take the *Braziliensis* to be a form of the *W. arrhiza* of Europe. — HENRY GILLMAN, *Detroit, Michigan*.

ANTHERS OF PARNASSIA. — In the "Journal of the Linnæan Society," vol. xi, Mr. A. W. Bennett published, two or three years ago, an interesting article upon *Parnassia* — its structure, affinities, and its mode of fertilization. I am now to remark only upon its anthers, which are generally described as extrorse. Mr. Bennett, observing that the present writer, in the "Genera of North American Plants Illustrated," describes the anthers as introrse, and gives a drawing of *P. Caroliniana* as an illustration, proceeds to say: "I do not, however, find any other observer to agree with Prof. Gray's observation in this respect, except two American botanists, Dr. Torrey and Mr. Chapman, who have probably borrowed their descriptions from him; nor do any specimens of this species which I have been able to examine confirm any departure in this respect from the ordinary type of the genus."

It is easy to show that Dr. Torrey's observation, at least, is independent and original. In his "Flora of Northern and Middle States," published in 1824, p. 326, he described the anthers of *P. Caroliniana* as "incumbent;" in his "New York State Flora," 1843,

as "fixed by the base, introrse." The first volume of the "Genera North American Illustrated" appeared in 1848. This season I have, for the first time, had the good fortune to see both *P. palustris* and *P. Caroliniana* in flower, in the Botanic Garden of Harvard University, the former blossoming at the beginning, the latter at the close of August. The difference between the two species "in this respect" is obvious.

In *P. palustris*, the anthers are certainly extrorse as to insertion; but the line of dehiscence lateral, with introrse rather than extrorse tendency.

In *P. Caroliniana*, the anthers are quite as much introrse as extrorse as to insertion, and truly introrse for dehiscence. A transverse section removes all doubt, showing the connective or solid part to be posterior, and the anther to be as truly introrse as possible.—A. Gray, *American Journal of Science.*

Geographical Distribution of Sea Grasses.—Under this title, Dr. P. Ascherson gives an account, in a recent number of Petermann's "Geographische Mittheilungen," of the distribution of the species of flowering plants native to sea water. Of these he enumerates twenty-two, belonging to eight genera, and two natural orders. The area of each species is generally very limited, its distribution being mainly dependent on the present condition of the sea in which it is found, as to temperature, etc. Those which grow in temperate regions are frequently represented by closely allied species in tropical seas. Although the Isthmus of Suez is of comparatively recent geological date, the nine species found in the Red Sea are entirely distinct from the four species of the Mediterranean, and, with one exception, belong to different genera. A good map accompanies the paper.—A. W. B.

The Structure of Bog Mosses.—Dr. R. Braithwaite, the highest authority in England on the mosses, has published in a recent number of the "Monthly Microscopical Journal," an account of the structure of the *Sphagninæ* or Bog-mosses. Dr. Braithwaite follows Schimper in considering them as a distinct order of the same rank as the true Mosses and Liverworts; the muscal alliance being thus formed of the three orders *Bryinæ*, *Sphagninæ* and *Hepaticinæ*. The spore of the bog mosses does not, on germination, produce the much-branched confervoid pro-

thallium of mosses; but, if growing on wet peat, a lobed foliaceous production similar to one of the frondose Hepaticæ; if in water, the prothallium is a fine filament, the lower end of which forms roots, and the upper enlarges into a nodule, from which the young plant is developed. The male organs of *Sphagninæ* differ also from those of mosses, and, in the arrangement and form of the antheridia, resemble those of Hepaticæ. They are grouped in spikes at the tips of lateral branches, each of the imbricated perigonial leaves enclosing a single globose antheridium on a slender pedicel. Paraphyses surround them; but, instead of being simple, as in mosses, they are very long, much-branched, and of cobweb-like tenuity. The leaves of the bog mosses are very peculiar and form well-known and beautiful microscopic objects. They are remarkable from the cell-walls being perforated by holes, through which it is common to find that infusoria have passed, which may be seen sporting about in the cell-cavity. — A. W. B.

Peloria in Labiatæ. — In a recent number of the "Sitzungsberichte der Kais. Kön. Akademie der Wissenschaften" of Vienna, Dr. J. Peyritsch records the continuation of his investigations of Peloria, or abnormal irregularity in the flowers of the Labiatæ. He finds the pelorial flower to be very commonly the terminal one in the inflorescence, the lateral ones being of the usual bilabiate type. The numbers of the parts of the calycine, corolline, and staminal whorls vary from two to six, the number being sometimes uniform throughout, and sometimes varying in each whorl; by far the most common arrangement being four of each. The pistil is usually quite regular, but in one instance the ovary was found to be six-lobed, surmounted by a single style and three stigmas. Examples of Peloria are recorded in the following species: — *Galeobdolon luteum*, *Lamium maculatum*, *Ballota nigra*, *Clinopodium vulgare* (one only), *Calamintha Nepeta*, *Micromeria rupestris*, *Nepeta Mussini*, *Nepeta Cataria*, and *Brunella vulgaris*. The abnormal development was found more frequently in plants grown in the Botanic Gardens than in the wild state. The paper is illustrated by several excellent lithographs. — A. W. B.

Lemna trisulca in Flower. — The flowering of the Cruciform Lemna (*Lemna trisulca* L.) is of such extremely rare occurrence, that my discovering it on Belle Isle, in the Detroit river, will be

deemed worthy of record. Floating on the surface of a small pond on this island, which is opposite the east end of our city, I found, on July 16, 1871, an abundance of the flowering *trisulca*, associated with *L. minor* L. and *L. polyrrhiza* L.; though the latter were greatly in the minority. I enclose specimens, from which will be perceived the remarkable difference of the plant from the usual submerged form. The flowering plant, it appears, is always of this small, compact, depauperate-looking type, and is provided with air-cavities which float it to the surface. The fronds are mostly proliferous from but one side, and the stalks are either much reduced or wanting, only five or six generations being connected; from which it would seem that this is a young state. I was not able to observe whether the posterior stamen opens later in the day than the anterior one, as Dr. Engelmann has surmised; but I found that a large number of the flowers had both stamens expanded at five o'clock, P. M. The exsert stamens were in such cases quite distinguishable by even the naked eye. Many of the plants were in bud, or about going to flower, having the anthers still enveloped in the spathe. I have collected a quantity of specimens which I shall be glad to distribute among my botanical friends. I hope to be able, at a later date, to secure the fruiting plant.

Last season (June 7, 1870) I discovered in the greatest abundance *L. minor* L. in full flower, at Eaton Rapids, Michigan, the locality so celebrated for its mineral springs. This plant also is rarely found flowering.—Henry Gillman, *Detroit, Michigan.*

Lemna polyrrhiza in Flower.—I have to add to my former discoveries of flowering Lemnas, the finding of *Lemna polyrrhiza* L. in full blossom. I found it, July 30, 1871, at the west or opposite end of the same pond on the Belle Isle, in the Detroit River, Michigan, in which two weeks previously I collected the flowering *L. trisulca*. Here the *L. polyrrhiza* was largely in the majority, though growing with *L. minor* and *L. trisulca*; all three species being in flower together! At four o'clock, P. M., I observed many of the flowers of the three species with both stamens expanded. I was unable to reach the ground at an earlier hour. The analyzed flower exhibits two ovules. I enclose specimens. *L. polyrrhiza* was found in flower last year for the first time in America by Mr. Leggett of New York—and, I believe, the first time

anywhere for twenty or thirty years — at least the first time to give it a critical examination. The great rarity of the flowering of *L. polyrrhiza* is almost mysterious. Though I believe I have been enabled to throw some light on this matter, yet as I am not positive as to the correctness of my conclusions without further experiment, I refrain from printing them. — HENRY GILLMAN, *Detroit, Michigan.*

ZOOLOGY.

AQUARIA STUDIES.— At the outset of the present sketch we would premise that the glass side of our aquarium which is placed next to the wall, is never cleaned, and in consequence of this, it is soon covered over with a growth of what botanists call Confervæ. The Confervæ are among the lowest forms of Algæ, a group which contains a great number of very minute microscopic plants, which have been, of late years, specially studied by microscopists. Among the lower forms of these Protophytes are the Diatomaceæ, Desmidiæ and Volvocinæ, plants of very simple organization, only lately removed from the animal kingdom. Other orders are the Palmellaceæ, likewise plants of humble type; Ulvaceæ, plants of a rather more complex character; Oscillatoriaceæ, remarkable for a peculiar kind of motion; Nostochaceæ, Siphonaceæ, and Confervaceæ.

First let us scrape some of the growth off the glass at the back of the tank, then place it in the live box with a drop of water over it, and having adjusted our microscope, what do we see?

First of all notice the vegetation contained in this drop of water. That long pointed ribbon, having the green colouring matter twisting and curling through the centre, is one of the Confervæ, a species of Spirogyra, and close beside it there is another jointed species having the chlorophyll or colouring matter in patches; this is a variety of Stigeoclonium. These are purely vegetable, and are the resort of many little creatures which revel and hide themselves among their tiny clusters of bands.

The first intruder in the field of the microscope we would call attention to is that shapeless mass near the centre. It looks like a small piece of clear jelly with little black dots or granules within. But see, it has changed its shape: it is, as it were, running out; a finger-like process is flowing out here and there; the

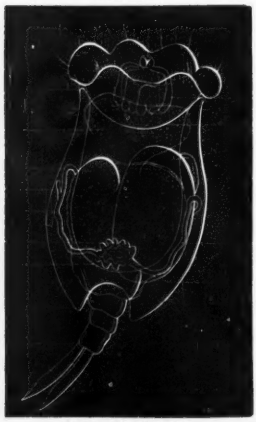
granules also are moving. Again we look; it has now assumed a shape something like an outline of a map of Italy. While you are looking it has again changed. You ask what is that? That is one of the simplest forms of animal life; it is called the Amœba or Proteus. (Fig. 111, *Amœba diffluens* Ehr. This and the other figures illustrating this article are copied from Clark's "Mind in Nature.")

Fig. 111.

Amœba diffluens.

In the Amœba we see an animal that breathes without lungs or gills, digests without a stomach, moves without limbs, and contracts without muscles. Like other animals of simple type, which live for the most part in the deep sea, and which from the possession of root-like feet, are called Rhizopods, its body is composed of a jelly-like substance called sarcode. Some of these creatures have silicious and some calcareous shells, while others have none at all. You will ask how does the Amœba live, and how does it feed? We shall endeavor to show. Although without a nervous system, it is nevertheless very sensitive, as will be seen.

Fig. 112.



Squamella oblonga.

That other creature near it is a Rotifer or wheel-bearer. If you watch you will now see how and upon what the Amœba feeds. As its body flows and contracts, it is nearing the Rotifer which is attached by its foot to the glass, unconscious of his fate. Presently the little mass of jelly flows and touches him, but too late for the Rotifer to make his escape; as if stimulated by the contact, the Amœba has fairly covered him, and through its transparent body the Rotifer's struggles for life are perceptible. All is over with it now, the laws of absorption have so decreed it, and soon nothing will be left of it but its silicious covering. This is the way the Amœba feeds, by absorbing the juices of its victim. This creature is reproduced by fission.

that is, by splitting or dividing itself into pieces, each of which becomes a perfect animal. (Fig. 112 represents a Rotifer, the *Squamella oblonga* Ehr.)

The wheel animalcule (*Rotifer vulgaris*) will be our next subject for examination. He is many degrees higher in the scale than the Amœba; his body is constructed in some degree on the principles of the tube of a telescope; he can also draw himself into a ball at pleasure; he has a mouth and jaws, which are constantly at work; his eyes are distinctly visible. When fishing he attaches himself by a foot or tail-like process either to the glass or to the stems of aquatic plants and stretches himself out, when the entrance to his mouth opens and the cilia, or hair-like appendages with which his mouth is furnished, commence moving or rushing, thus causing a current or small whirlpool in the water, by means of which monads and other animalcules are drawn in, and amongst others our friend the Amœba falls in, so that the victor of yesterday is the victim of to-day.

Rotifers are produced from eggs, although in one species (*Actinurus neptunius*) we have distinctly seen the young one in the body of the parent, and not only so, but have noticed its jaws going as if the creature was feeding. The red eyes of the young Actinurus could also be distinctly seen.

When swimming, the Rotifer is a very graceful creature; with his crown of cilia extended, he glides across the field of view with amazing swiftness.

We well remember when young at microscopy, the anxiety experienced to possess a Rotifer; the quantities of infusion of leaves of all sorts we made, including hay, straw and sage, but to no purpose. We could get lots of monads and other varieties, but no Rotifer. For two years this state of things went on, when we were tempted to bottle some water from one of the street puddles, taking some of the sediment with it. The bottle was placed uncorked, in the window, so that the full benefit of the sun-light might be obtained. As soon as business was over that day the bottle was produced, the animalcule cage filled, the focus of the microscope adjusted, and to our delight, the water was swarming with Rotifers; and from that day to this, we have been close companions. This water was kept for nearly three years, and fresh water now and then added to compensate for evaporation, with a little piece of pond-weed (*Anacharis alsinastrum*), or duck-weed (Lemna)

to keep the water sweet. Many generations of Rotifers lived and died in that bottle, as their silicious skeletons testified, the sediment being full of them.

Temperature has very little effect on Rotifera. We have had a bottle of water containing these creatures frozen solid, and on thawing them, they were as lively as ever. We have also placed a large-sized drop of water on a slip of glass, and held it over the flame of a lamp, long enough for the glass to be uncomfortable to the fingers, with the like result. They only appeared to be a little more active after their warm bath.

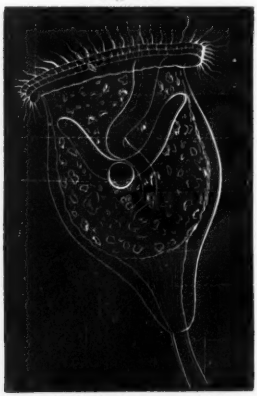
Fig. 113.

Epistylis flavicans.

The old experiment of evaporating a drop of water on a slide containing Rotifers we have also tried, and on again wetting the spot, have resuscitated some of them. We have had them the twenty-fifth to the thirtieth part of an inch in length; about the fiftieth part of an inch is the usual size.

A little to the left of the Rotifer, attached to a piece of Conferva, is a beautiful cluster of bell-shaped animalcules, *Vorticella campanularia*. They are attached to the plant by means of a stalk, which has a contractile muscle running from the base to the upper end: they have a ciliated mouth. Just watch that little cluster of crystal bells. They have by means of the muscle drawn back until they look like an irregular mass of gelatine. Now they slowly move out again, as if all were guided by the same will. Now they are at full stretch, with cilia revolving, fishing and feeding. Again, they are all retracted with a jerk. Some of them look as if they were double. Reproduction is going on in these: it is effected by fission. Bye-and-bye these will separate and detach themselves, and swim about till matured, when they attach themselves, to go through the same existence as their progenitors. (Fig. 113 represents a vorticellidan, *Epis-*

Fig. 114.

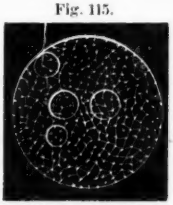


Epistylis flavicans, magnified.

tylis flavicans slightly magnified; Fig. 114, the same magnified 250 diameters).

A smaller species, *Vorticella nebulifera*, is to be found attached to the bodies of some Entomostraca, as *Cyclops quadricornis*, and on *Lynceus*. Another species (*Carchesium polypinum*) is also found attached to these creatures. We have a specimen of Cyclops, mounted as a microscopic object, having *Vorticella nebulifera* attached to the back of the crustacean. The presence of the Vorticella on the slide was accidental, as the object was intended to be *Volvox globator* (Fig. 115) only. It evidently got in, either attached in some way to some of the Confervæ, or from the water.

Fig. 115.



Volvox globator.

The stalks in Carchesium are not retractile; the body, however has the power of closing up by muscular action. These we have not found in numbers in our aquarium, but in the ponds near the city they are to be met with in abundance.

Another beautiful creature — the Blue Stentor (*Stentor cæruleus*) — has attached itself to a little bit of weed; its beautiful crown of cilia is expanded, and moves rapidly, creating quite a small whirlpool, into which the unfortunate monads are drawn and engulphed into its stomach. It is of a beautiful blue colour, and is found in great abundance at times on the tops of ponds, which look then as if covered with coal dust. (Fig. 116 represents *Stentor polymorphus* Ehr).

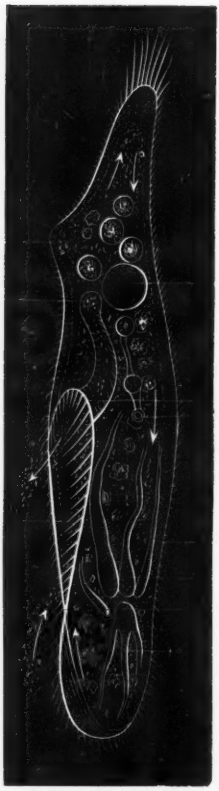
Fig. 116.

Stentor polymorphus.

On taking another drop of water from the aquarium, with more of the vegetable matter, we observe other and different creatures, resembling snakes twisting and entwining each other in their folds; these are called Lurcos or Gluttons. They are well named, for they are very voracious, feeding

on animal and vegetable life; their bodies are annulose, or composed of rings having hair-like processes on each segment, which enables them to move about with considerable quickness; their mouth is capacious and ciliated; the intestinal canal is plainly seen, and their food can be well observed through their transparent bodies. We have seen them devour rotifers, monads, bell animalcules and other animals; in fact they refuse nothing. They are produced from eggs.

Fig. 117.



Paramecium caudatum.

That slipper-shaped species is very common, and found in great numbers; it can be seen by the unassisted eye as a tiny speck coursing across the animalcule cage. It is called the Chrysalis animalcule (*Paramecium aurelia.*) It is ciliated all round the sides of its body, and moves about very swiftly; it is like a porpoise in a shoal of herrings—dashing here and there, devouring the smaller species, such as monads, in all directions. It undergoes many changes, and assumes many shapes during its metamorphosis; it is produced by fission as well as from the egg. (Fig. 117 represents *Paramecium caudatum* Ehr.)

That restless little fellow with four horns is *Cyclops quadricornis* (Fig. 118). The only way to get a good look at him is to bring a little pressure to bear by giving the cover of the live-box a slight squeeze so as to keep him still. He is very active, and measures about the sixteenth part of an inch in length. His head is furnished with four antennæ or horns, and the creature is provided with five pairs of feet and a long tail, which is terminated by bristles. It has in the centre of its forehead, a single red eye—hence the name Cyclops, after Vulcan's workman. The legs of the Cyclops at each of the joints, are furnished with hairs, evidently to help the creature in swimming, as is also the case with aquatic beetles. The female carries two ovaries at the extremity of the abdomen,

where the eggs are hatched, and, on the young leaving these sacs, they fall off. The young, according to Carpenter, undergo five changes in their development.

Besides these little creatures we have mentioned there are many more about which much might be said.

We have monads, vibrios in great numbers, always present in the water of our aquarium: not only there we may state, but in the Montreal water this spring we detected in two instances, living vibrios in the water immediately taken from the pipe.

Fig. 118.

Cyclops quadricornis.

In concluding this sketch of the inhabitants of our aquarium the following remarks may not be out of place.

How little is known, by the great mass of mankind, of the various creations possessed with the wonderful and unknown principle, "life," respecting which much more might, perhaps, be known by means of patient microscopic research. By its aid we may learn how admirably each little organ plays its part, and how the various members contribute to each of these creatures' happiness in their struggle for life, for, for some wise purpose, every animated being, from the monad to the whale is battling for existence.

There is not, perhaps, a single species of animated being whose existence depends not, more or less, upon the death or destruction of others.

In the plan of nature death and dissolution seem to be indispensable for the support and continuance of animal life.

Man may be said, with a few exceptions, to have universal empire over the other animals. Carnivorous animals and birds are also engaged in this general work of destruction.

In fishes, also, as their habits demonstrate, from the least to the greatest, their appetite is almost insatiable, and their object in life seems to be either to devour other fishes or to avoid their own destruction.

Insects, also, are no exception to the rule. We find the same

struggle going on among them, each preying on, or being preyed on by other species.

Even in our aquarium this struggle can be witnessed, as illustrated in the first part of these sketches; also among microscopic creatures, the subject of the present paper. They also have their enemies, the fish swallow them in countless thousands, while the smaller ones supply the larger ones with food.

In the economy of nature no creature lives for its own happiness alone, but by its destruction, contributes to the happiness of others. The balance of power is not entrusted to any particular class or species, and He who in wisdom made them all governs and guides the whole.—A. S. Ritchie, *in Canadian Naturalist and Geologist.*

Hybrid Between Cat and Raccoon.—I saw yesterday (May 2d, 1871) the most interesting hybrid animal I ever examined; and hasty as the examination was, it may be worth mentioning. Passing through Taunton, Mass., I saw in the doorway of Mr. Dunbar's bookstore what struck me, at first, as being the handsomest cat I had ever beheld. The second glance revealed an unmistakable look of wildness; and, for a moment, it seemed to me that it must be some creature of the squirrel kind, at any rate something else than a cat. On inquiry, I found it to be the offspring of a domestic cat and a tame raccoon, kept in the same family in China, Maine. I was informed that there had been several litters of these hybrids, and Mr. Dunbar had before owned one of a previous litter. That had been stolen, and he had obtained this younger one, now seven months old, from Maine.

She is larger than an average cat of that age, and is at once distinguishable both in shape and color. The color is a dark tawny, brindled with streaks that are almost black, on body and legs, and more obscurely on the tail. The under side of the body is lighter, as you will see from the matted hair which I enclose, and which was cut from the under side of one of the hind legs. (She is just now shedding her hair.) All the darker tints are quite unlike any that I ever saw in a cat. In shape she is somewhat slender, I should say, though this is concealed by the great length of the hair. The legs seem longer than a cat's, and there is something peculiar in her gait as if they were set on differently. Her walk is neither plantigrade nor yet quite feline, while it is easy and not

ungraceful. I noticed no peculiarity in the paws, but the owner said she used them "unlike a cat, more like a squirrel." The head looks more triangular than a cat's, possibly, from the pointed and tufted ears, which are quite peculiar. The expression of the creature's face was so wild and formidable that I actually hesitated to touch her, but found her gentle and caressing, beyond even the habit of cats; she seemed more sympathetic and human, instead of less so, which surprised me. But the chief beauty was in the hair which I found to be very long and silken, with a softness such as I have rarely felt in any quadruped, except at a very early age. This characteristic attains its greatest perfection in the tail, which does not in the least remind one of a cat's, but is as bushy and ornamental as a squirrel's — broad, and waving and graceful. I am not well acquainted with the raccoon, though I have seen it alive; but it seems a remarkable and interesting circumstance that a hybrid should have a softness and silkiness of coat beyond that of either progenitor.

The owner has had this beautiful animal but a few weeks, and had the elder specimen of the same race but a day. He says that this one is ordinarily quite gentle and docile; but that, on one occasion, being taken up by the tail, she turned upon the aggressor with a fury far beyond that of a common cat. She also never retreats before a dog, and the dog usually retires. She feeds on milk and meat, like a cat; but has never yet caught a mouse, perhaps for want of opportunity. She is peculiarly nocturnal in her habits; is quite drowsy by day (which I also noticed) but becomes playful at night, and is always found rambling about the large shop in which she is confined.

Mr. Dunbar states that the other specimen of this breed, which he previously owned, resembled this one in color and shape, but not in the length of hair, having more resemblance in that respect to the common cat. It would be exceedingly interesting to compare the different offspring of this strange union. I was unable to ascertain which of the parents — cat or raccoon — was the female; nor could I obtain the name of the person in China, Maine, beneath whose roof these singular hybrids were produced. Possibly, you may have some correspondent in that locality who could give more accurate information. If it were possible to overcome, in this case, the ordinary infertility of hybrids, I am confident that there would be quite a demand for animals of this breed, for their beauty alone. — T. W. Higginson, *Newport, R. I.*

We give the following copy of a letter received by Mr. Higginson:—

"Dear Sir;—your favor was received on Wednesday night and Thursday morning I went over to Taunton to see the cat. It is certainly a hybrid and I am very confident Mr. Dunbar is right in believing it to be a cross of the raccoon and cat. 1st. Its tail in markings and bushiness is strongly coon, as well as the markings of its fore and hind legs and paws. 2d. Its walking gait particularly in the handling of its hind legs is purely coon. 3d. Its disposition is astonishingly wild intermingled with tame. 4th. I understood Mr. Dunbar that his brother-in-law brought the creature from China, Maine, and was assured by the man of whom he obtained it, that it was an *intentional* hybrid of the coon and cat, and not accidental, which to my mind makes it much more probable. Mr. Dunbar promised to get the name of the original owner, and also to let me have the cat to stuff, if it should happen to die. He has also sent for a male hybrid, and if he gets it will inform me. This cat will soon have kittens, and as I am frequently in Taunton, I shall follow up the enquiry with interest. Thanking you for drawing my attention to the queer specimen, and promising to give you farther information as fast as I obtain any

I am, Yours respectfully,

J. W. P. Jenks."

Ornithological Notes from Maine.—Mr. G. A. Boardman of Calais, Me., writes us that he has a Florida Gallinule, *Gallinula galeata*, that was shot near Calais this last spring. Also a *black* Golden-winged Woodpecker, *Colaptes auratus*, black as a grackle and breeding with a woodpecker of the usual color. An albino of the Little Black-headed Duck, *Fulix affinis*, has also been added to his collection, and he found a pair of Red-headed Ducks, *Aythya Americana*, breeding near Calais. This is the first time he has found the Red-head in summer.

A New Species of Alligator.—Dr. Schulte-Buckow, who has travelled extensively in South America, gives in the New York "Zeitung" an interesting account of the habits of the alligators. He discovered a new species, which has been described by Prof. E. D. Cope under the name of *Prosuchus fuscus*.

The Duck Hawk.—Mr. William Jarvis of Hanover, N. H., writes us that he found the nest of a Duck Hawk on Eagle Cliff, near the Profile House, Franconia Notch, last summer. The young were able to fly from the nest, which was made of a few dry sticks placed round a slight hollow on a shelf of the cliff.

ANTHROPOLOGY.

THE FLATTEST TIBIA ON RECORD.—In the Fourth Annual Report of the Peabody Museum of American Archæology and Ethnology (1871), reference is made (pp. 21, 22,) to a certain tibia obtained by me with other similar relics, in 1869, from an ancient mound on the River Rouge in Michigan. It is mentioned as the most extreme case of the flattening of this bone, the transverse being only 0.48 of the fore and aft diameter. Tibiæ from mounds in other parts of the country give the extent of this flattening as 0.60; and in the "most marked case mentioned by Broca, viz., in the old man from Cro-Magnon" (France), it was 0.60.—But I have lately met with several cases presenting this flatness in even a greater extreme; and I have now in my possession two tibiæ, evidently of great antiquity, taken from a mound on the Detroit River, in one of which the short is 0.42 of the long diameter, and in the other only 0.40. This last, therefore, may be considered as the flattest tibia on record. In both, the bone is curved, being remarkably convex forwards. A large amount of the most interesting relics of the ancient mound-builders was associated with these bones, which were selected from among the remains of eleven human bodies. Some of these relics give evidence of the identity of this race with those of the "ancient miners" of Lake Superior, or, at least, of their intercourse; others give evidence of traffic with the southern races—perhaps along the Gulf of Mexico. In all of the mounds along the Detroit River and its tributary the River Rouge, I find a large majority of the tibiæ presenting this flattening. This appears to be an exception to the facts as noted in other parts of the country where the flattening has been estimated as pertaining to "only about one-third of all the individuals observed." Here a tibia not flattened is the exception. And I would further state that where this bone is found approximating to the equilateral, it is manifestly of subsequent burial, and of much later date. This region, at the junction of the Detroit and Rouge rivers, was known formerly as "the Paradise of the Indians," and they evidently congregated here in large numbers.

Prof. Wyman's interesting comparison of the mound-builders with the ancient races of Europe, in which the flattening of the tibia was one of the peculiarities, as also his allusions to the same

characteristic in the corresponding bones of the ape, will not fail to receive attention. He says—"In some of the tibiæ the amount of flattening surpasses that of the gorilla and chimpanzee, in each of which we found the short 0.67 of the long diameter, while in the tibia from Michigan it was only 0.48." Similar comparisons of the other bones, particularly of a large number of crania and of the pelvis, are equally suggestive, and render this one of the most valuable of the reports issued by the trustees.—HENRY GILMAN, *Detroit, Michigan.*

THE TANIS STONE: A NEW TRILINGUAL.—A trilingual stone recently discovered in excavations made at Tanis, on the eastern or Pelusiac branch of the Nile, has been deposited in the Museum of Egyptian antiquities at Cairo. It is a perfect stela, about six feet high, two and a half feet broad, and a foot thick, the summit arched. The inscriptions cover one entire face and most of one side; hieroglyphics occupy about three-fifths (the upper portion) of the face, the Greek version the remainder, while the Demotic translation covers scarcely more than two-thirds (the upper part) of the left side. The letters are small, closely crowded, and all perfect and sharply cut, the stone not having been defaced in the slightest degree; in the extent and perfection of the inscriptions, it is, therefore, much superior to the "Rosetta stone." Plaster casts of the Tanis stone have recently been taken, and copies sent to the museums of London and Berlin; and through the intercession of the American consul, Col. Butler, at the instance of Rev. Dr. Lansing, one of the American missionaries stationed at Cairo, a copy is now preparing for Monmouth College, in Illinois. —S. H. SCUDDER.

GEOLOGY.

REMARKS ON FOSSIL VERTEBRATES FROM WYOMING.—Prof. Leidy remarked that the collection of fossils presented at the meeting of the Philadelphia Academy of Natural Science, August 8, by Drs. J. Van A. Carter and Joseph K. Corson were of unusual interest. They consist of remains mainly of turtles, with those of mammals and crocodiles, and were obtained from the Tertiary deposits in the vicinity of Fort Bridger, Wyoming Territory.

The great abundance of remains of turtles, of many species and genera, of fresh-water and terrestrial habit, obtained in Wy-

oming, indicates this region to have swarmed with these animals during the earlier portion of the Tertiary period. Crocodiles and lacertian reptiles were likewise numerous. The many mammalian remains found in association with the reptilian fossils mainly belong to tapiroid and carnivorous animals.

The Wyoming Tertiary fauna presents a remarkable contrast with the later faunæ of the Mauvaises Terres of White River, Dakota, and of the Niobrara River, Nebraska. Among the large number of fossils from these two localities, rich in evidence of mammalian life, there occur the remains of a single species of turtle in each, and none of crocodiles or other reptiles.

Dr. Carter's collection, besides containing remains of *Trionyx guttatus*, *Emys Jeanesianus*, *E. Haydeni* and *E. Stevensonianus*, and *Bœna arenosa*, also adds two new turtles to the list. One of these is a species of Emys of the largest size, and exceeds any now living. The carapace has measured about two feet and a half in length, and the sternum about two feet. In honor of its discoverer, it may be named *Emys Carteri*.

The first and second vertebral plates of this species present an unusual, perhaps an anomalous appearance. The first is four inches long, and clavate in shape with the narrow part foremost. The second is two and one-fourth inches long, and presents the usual hexagonal form reversed. The third plate, a little longer, is quadrate with convex sides. The first vertebral scute is vase-like in outline, five and one-half inches long, two and three-fourths inches wide in front, four and three-fourths inches near the middle, and three and one-half inches at the back border. The second scute, of the ordinary form, is five inches long, and four inches wide.

The second turtle belongs to the recently characterized genus *Bœna*, but is considerably larger than its associated species which have been described. The shell in its complete condition, has been upwards of a foot and a half in length, and is seven inches and a half high. The sternum is flat, and about fifteen inches long. Its pedicels ascend at an angle of about 45° and are seven inches and a half broad. As in the living Dermatemys, and the sea turtles, they are covered with large scutes, four in number, as in *Bœna arenosa*. The intermediate vertebral scutes are longer than broad — the third being four inches long, and three and one-half inches wide. A peculiarity of the species is the undulating

manner in which the costal scutes join the marginal scutes, and the sternal scutes one another. The species may be named *Bæna undata*.

Dr. Carter's collection also contains some fragments of bones of a large mammal, which are so mutilated as to be hardly characteristic. A jaw fragment among them, with the retained fragments of the true molars, would appear to indicate a species of *Palæosyops* much larger than *P. paludosus*. In absence of other evidence, it might be viewed as a species of this genus, under the name of *P. major*. The true molars occupied a space of four and a half inches. The last molar measured an inch and seven-eighths fore and aft, and an inch transversely in front.

Dr. Carter had also sent some fossils to Prof. Leidy, among which were portions of jaws, with nearly full series of teeth of *Hyrachyus agrarius*. This animal is related to the Tapir, Hyracodon and Lophiodon. The formula of its dentition, is the same as in Hyracodon: seven molars, one canine, and three incisors. The true molars are like those of Lophiodon, except that the last lower one has a bi-lobed instead of a triple-lobed crown. Apparently the same animal has been indicated by Prof. Marsh, under the name of *Lophiodon Bairdianus*. A fragment of a lower jaw containing the last premolar, and the first true molar, indicates a larger species of *Hyrachyus*, which may be named *H. eximius*. The crown of the last premolar is seven and one-fourth lines antero-posteriorly, and five and one-half transversely. The true molar has measured about eight and one-half lines, fore and aft, and six lines transversely. The depth of the jaw fragment below the true molar is over an inch and a half.

Another fossil is a mutilated incisor, indicating a species of *Trogosus* rather more than half the size of *T. castoridens*, which may be named *T. vetulus*.

A femur of *Palæosyops paludosus* in the collection, exhibits the third trochanter, characteristic of the unequal-toed pachyderms. The astragalus of this animal almost repeats that of the living tapirs.

Among the remains of Dr. Corson's collection, there is the greater part of the lower jaw of a large crocodile, but too much broken to attempt to give an opinion in regard to its specific character, until it is in some degree mended or restored.

NOTES.

William Blackmore, Esq., the munificent founder of the "Blackmore Museum," in his native town of Salisbury, England, (which we are authorized by Mr. Squier in saying is the finest illustration of that part of "prehistoric" archæology denominated the "Stone-age" in the world) is anxious to obtain all possible information regarding the range of the buffalo at the time of the settlement of this country. Mr. Blackmore purchased from Dr. Davis his portion of the antiquities of the west which formed the basis of the first volume of the "Smithsonian Contributions." Any information on the points indicated above, if sent to the care of Mr. E. G. Squier, 135 East 35th St., New York, or communicated to this magazine, will be highly appreciated.

Prof. Albert N. Prentiss of Cornell University has taken the first Walker prize offered by the Boston Society of Natural History. The subject was "The Mode of Natural Distribution of Plants over the Surface of the Earth."

The veteran Herpetologist and Ichthyologist of America, Dr. John E. Holbrook of Charleston, S. C., died at Norfolk of apoplexy on Sept. 8th, aged seventy-six years, eight months. Dr. Holbrook's principal publications were the *Herpetology of North America*, in four quarto volumes containing descriptions and colored figures of all the North American Reptiles known at the time, and the *Ichthyology of South Carolina* in similar style. The former work went through two editions and is to this day the basis of our knowledge of the reptiles of this country. Of the latter work only one volume was published, as the war prevented its completion by the state of South Carolina, though we have certain knowledge that the drawings and descriptions of the concluding volume were in an advanced state, if not even ready for the press at the breaking out of the war.

Mr. S. I. Smith, Assistant in the Sheffield Scientific School, has been appointed State Entomologist of Connecticut.

Mr. J. A. McNiel proposes to make another expedition (the fourth) to the Pacific Coast of Central America. He will leave New York about the first of December and solicits orders for specimens in all departments. His address is Binghamton, N. Y.

It will be remembered that last year Dr. William Stimpson and others explored the bottom of Lake Michigan at great depths with the dredge, and with the most gratifying success. We learn that Mr. S. I. Smith, zoological assistant of the Sheffield Scientific School has been dredging during the past summer in the deepest parts of Lake Superior.

Professor Henry recently, in a few remarks before the California Academy of Sciences, presented the results of the meterological observations which have been made and collected by the Smithsonian Institution. The paper will soon be published. The rainfall of the United States comes from three different quarters, the Atlantic, Gulf of Mexico and the Pacific. Perhaps the largest comes from the Gulf of Mexico, the bottom, as we term it, of the trade wind. Although nothing appears more irregular than the rains in the Eastern States, a long series of observations establishes the fact that they are very regular.

The speaker explained briefly the law controlling the movement and precipitation of vapors, and exhibited several charts, showing on what months the maximum and minimum of rainfall were observed to occur in different localities and upon different areas.

He also displayed a number of the latest compiled charts, showing by graduated colors the comparative amount of the rainfall in various localities. He explained the fact of the rainfall being wholly absent in California in summer.

In Florida the rainfall was light in winter and heavy in summer, owing to the fact that in winter the trade wind which brought the rain took its course more to the southward. The temperature of Sitka was about seventeen degrees warmer than it would otherwise be from the influence of the summer trade winds.

In connection with the present condition of science, Professor Henry enlarged on the reasons why wealthy men should give liberally to the cause. Large donations had been made to the cause of education, while science was nearly neglected. This should not be. Education is merely the diffusion of knowledge already gained. The Chinese are highly educated, but they lack science,

and are therefore non-progressive. Science seeks constantly to add something to the general fund.

No civilization is possible without a concentration of power. The ancients had their power in slaves. The pyramids were built by slave labor. Athens had four hundred thousand slaves and twenty thousand masters. The civilization of those days was supported by the brute forces of man. The civilization of to-day is supported by the brute forces of nature. The latent force of the coal puts the life of a thousand horses into an engine. One ton of our best anthracite coal burned in one of our best engines, is estimated as being equal to two years of labor of an able bodied slave, working ten hours a day; and counting thirty years for his life, fifteen tons of coal would be equal to the life of an able-bodied slave.

It is in the further utilization of these brute forces of nature that the fortunes of our wealthy men lie. When men of intelligence understand that their fortunes depend on the advancement of science, they will be induced to give a small portion of their wealth to this end. Science seeks to enlarge knowledge. No name has gained higher honor than that of James Smithson, for the donation on which the Smithsonian Institution was founded. The only man who has followed his example is Professor Bache of the Coast Survey.

Scientific men should endeavor to impress on the wealthy that their interest lies in the advancement of science as well as the diffusion of knowledge already gained.

Professor Henry referred to his recent visit to Europe and to the rapid strides which science was making in England, and attributed it to the advantages which are given to those men who are pioneers in original discoveries.

A great degree of success has attended the researches carried on by Prof. Baird, the U. S. Commissioner of Fisheries, at Wood's Hole, Mass., during the past season from June till October. He has called to his aid several naturalists, and by their united exertions much light has been thrown upon the distribution of the fishes and the invertebrate animals which form their food. The fishes have been collected in large numbers, and will be worked up by Prof. Gill. Over two hundred photographs of fishes from life have been taken, including sharks and rays in different stages of

development, affording rich material for illustration. Dredging parties have gone out in every direction within a radius of thirty or forty miles, and an immense amount of material, including many new forms and others not before known to exist on this side of the Atlantic, has been accumulated. Among the more interesting discoveries are two Pteropods (*Cavolina tridentata* and *Clio aciculus*) not previously known upon our coast. The invertebrates will form the subject of an elaborate report with numerous plates, by Prof. Verrill and Mr. S. I. Smith. Among the fishes, sixteen species, new to the state, have been obtained and much information collected relative to the nature of the food and rates of growth of the species used as food. We hope in subsequent numbers of this journal to give farther information as to the scientific results of the commission.

Among the visitors to Wood's Hole taking part more or less in the exploration of the commission were Prof. A. E. Verrill, Prof. D. C. Eaton, Prof. W. D. Whitney, Mr. S. I. Smith, Prof. W. H. Brewer, Prof. Todd, and Mr. Thatcher of New Haven; Prof. A. Hyatt and Col. Theo. Lyman of Boston; Prof. L. Agassiz, Dr. Farlow and Mr. Whitney of Cambridge; Dr. A. S. Packard of Salem, Mr. J. Gwyn Jeffreys of London; Prof. Gill, Dr. Palmer, and Mr. Rockwell of Washington, etc.

We learn from the "Academy" that the British Government has expressed its willingness to support Dr. Carpenter's scheme of prosecuting deep sea explorations throughout the Atlantic, Indian, Southern and Pacific Oceans.

Under the title of "An Early Hero of the Pacific" "The Overland Monthly" for August has a very readable account of the life of DAVID DOUGLAS, the botanist, during the ten years, 1824–34, he passed on the Pacific coast.

A new edition, the third, of "Griffith and Henfrey's Micrographic Dictionary" has just commenced passing through the press. John Van Voorst publishes it at No. 1 Paternoster Row, London, at 2s. 6d. per part.—R. H. W.

The French "Cosmos," one of our most valued exchanges before the late war, has reappeared under the title of "La France Scientifique." The first number appeared Sept. 10th. Victor Meunier is the editor.

THE CHICAGO ACADEMY OF SCIENCES.

We take advantage of the delay in the publication of this number of the Naturalist, occasioned by our "Association Number" to place on record the great loss which science has met with in the destruction of the building of the Chicago Academy of Sciences with all its valuable collections and library, during the great fire on the 8th and 9th of October. We had visited the Academy in August and had been fully impressed with the value of its splendid collections, and while watching the telegraphic reports of the fire had hoped that these would at least be spared the fate that once before had befallen the Academy, but the receipt of letters, of which we give abstracts below, showed that our hopes were doomed to disappointment.

Chicago, Oct. 10, 1871.

"Among the other buildings involved, was the Chicago Academy of Sciences. It was considered fire-proof; but, in the fiery furnace, its iron shutters warped like pasteboard, and let in the devouring element, and a precious morsel it lapped up. There were the greater portion of the invertebrata collected by numerous explorers and in distant oceans, originally deposited in the Smithsonian Institution, but transferred here for especial study and description by Dr. Stimpson; the collection of mammals and birds made by Dr. Vaille, which cost him years of labor and travel; two skeletons of the mastodon; the collections of Kennicott in the Arctic region; of Stimpson on the Florida reefs and the Gulf Coast; the Cooper collection of shells, purchased by George Walker; an interesting series of implements in pottery and lava—the work of a prehistoric race—exhumed at San Jose, Mexico, presented by J. Y. Scammon; a large collection of minerals, rich in crystalline forms, which was secured through the exertions of Mr. E. S. Chesboro; an extensive suite of the coals and iron ores of the Northwest, and other objects of natural history. The Academy had become the resort for Scientific men desirous of studying not only the natural history of the Northwest, but of the whole country. Dr. Stimpson's MSS. relating to the invertebrates collected on the Japan Expedition, illustrated by numerous drawings—the labor of years, and ready for publication—were also consumed. But a short time ago Mr. J. Gwyn Jeffreys spent several days in examining our collections in reference to deep sea dredgings. But all are gone. The patrons through whose munificence the Academy was built up have shared in the general calamity. Many of the specimens cannot be replaced; but when the Academy shall arise like a Phœnix from its ashes is a matter of doubt. The present is not a time for consultation while the embers are yet alive, and while the smoke is yet ascending."—J. W. Foster.

Chicago, Oct. 12.

"Please stop the sale of the books and papers in the agency. We have not a copy left of any of them. The Academy building and everything in it was utterly destroyed—not a scrap of paper or a specimen saved. My own books, collections, MSS. and drawings—twenty years' work all gone!"—Wm. Stimpson.

At a meeting of the Essex Institute held Oct. 16th, the president, Dr. Wheatland, read short sketches of the Chicago Historical Society and Chicago Academy of Sciences. From the latter we abstract the following:—In 1856 the formation of a society for the promotion of the Natural Sciences was proposed, and in the following year the Chicago Academy of Natural Sciences was organized. A room was taken and a museum commenced, but owing to the financial crash that came upon the country, very little was done until the year 1859, when it was organized as a corporation under the title of the Chicago Academy of Sciences. In 1862 the lamented Kennicott returned from his three years' exploration in

the Arctic regions, richly laden with specimens, a part of which were to become the property of the Academy. In the winter of 1863-4 advantage was taken of Prof. Agassiz' visit to Chicago to gain his opinion of the value of the collections secured by Mr. Kennicott. His endorsement of Mr. Kennicott's work, and his urging the importance of the formation of a great museum in the Northwest was so strong an incentive that money was at once secured (a large sum being given at an impromptu meeting, afterwards greatly increased by the efforts of Mr. Scammon) and the funds placed in the hands of trustees for the formation of a Museum of which Mr. Kennicott was appointed Director. In 1863 Mr. Kennicott, in order to add to the materials of the museum, accepted the appointment on the Russian American Telegraph Survey. From this ill-fated expedition he never returned. At this time the charge of the museum was given to Dr. Stimpson. On June 7, 1866, a large part of the collection of over forty thousand specimens, and all the plates for the first part of the "Transactions" were destroyed by fire. Soon afterwards the text of the same volume while in the hands of the printer met the same fate. The Academy however started forward with renewed vigor, and erected what in any ordinary fire would have been a fire proof building. Its collections and library were rapidly increased, until, at the date of the present calamity it had within its walls one of the, in many respects, most valuable collections in the country, including the larger part of the crustacea and other invertebrates belonging to the Government and Smithsonian collections, and the crustaceans dredged by Pourtales, which had been sent to the Academy for Dr. Stimpson to describe. The State collection of insects made by the late Mr. Walsh, had also been deposited at the Academy.

The Academy had published its first volume of "Transactions" and forty-eight pages of its "Proceedings." The second volume of "Transactions" was in a forward condition, and many pages stereotyped and several plates printed and stored at the Academy.

After remarks on the great loss which science had met, and a description of the character of the collections destroyed, Mr. F. W. Putnam, vice president of natural history, offered the following Resolutions, which were seconded with remarks by Drs. Bolles and Morse, the president and others, and unanimously passed.

Resolved. That the Essex Institute tenders its sympathy to its sister society, the CHICAGO ACADEMY OF SCIENCES, in her second trial by fire, in which she has lost not only her buildings, but all her specimens, books and publications.

Resolved. That the Institute hereby promises to furnish such of its publications as the Chicago Academy of Sciences may desire, and to render such other assistance as possible in the efforts of the Academy to arise for a second time from the ashes.

May we not, as editors of the NATURALIST, make a special appeal, at this hour of generous free offerings to the suffering people of Chicago, and ask for aid and sympathy for the Academy of Sciences that was doing so much for the cause of education in the great Northwest. Can we not hope, even though so much is yet to be done for the homeless of the great city, and the other towns that have been simultaneously devastated by fire, that the friends of science will aid all they can in giving encouragement to the members of the Academy in this severe trial?

ANSWERS TO CORRESPONDENTS.

M. H. P., Junction City, Kansas.—The common Columbine with full, double, regular flowers destitute of spurs, *i. e.*, with the petals multiplied and transformed into sepals, is a wellknown old plant, not very rare in gardens. But flowers with only five petals and those spurless are unknown to us.

A. H. Y., Hanover, Indiana.—As to new Trillium, considering what vagaries the species sometimes show, it will be in good time to consider the one referred to when any specimen of it is known to be extant, and when we have seen it.

C. G. A., Augusta, Maine.—Your plants are, 1, *Corinia Conradii*; 2, *Geranium dissectum*; 3, *Myontis palustris*; 4, *Empetrum nigrum*; 5, *Vaccinium Vitis Idæa*.

R. C., Cincinnati.—There is as yet no work that comes up to what you want, but we have now in press a work by Dr. Coues that is intended to supply just such wants as yours. It will be a perfect text book of Ornithology and in addition will contain a synopsis of *all* known birds of North America, and an artificial key, by means of which any species of North American birds can be readily identified without previous knowledge of ornithology being necessary. The book will be illustrated with several hundred cuts and several plates.

V. B. L. New York.—Your lichens are—1, Cladonia degenerans; 2, Parmelia tartarea Var. frigida; 3, Sphæria convergens; 4, Lecidea disciformis; 5, Lecanora cinnabarina; 6, Cenangium plicatum; 7, Lecanactis sp.; 8, Lecidea exigua, and Lecidea cerna on the same piece of bark; 9, Parmelia crinita.—J. L. R.

"In the NATURALIST for August, 1870, in the article upon 'Flowerless Plants,' the writer speaks of a species of Clathrus. Can you give me any more of a description of it? For two years, at long intervals, we have had a fungus in a bank at the front of our house, which I think must be this Clathrus. We do not perceive it until the nauseous odor appraises us of its existence. Then we dig it up and burn it; and, following some one's advice, I know not whose, salt the hole from which we dug it. The writer of the article referred to, says it is 'a putrid, revolting, jelly-like mass of raw flesh, just *beneath* the loosely-lifted soil.' The one I speak of seems to come *above* the soil, about two inches before this jelly-like mass appears. Please tell me something about it, if you can, and if there is anything we can do to prevent its recurrence. Perhaps some other reader of the NATURALIST would like to know about it, and you would prefer to answer through its pages."—E. M. B.

We have referred the matter to a well-known botanist, who sends the following reply:

"If the fungus to which you refer be a Clathrus, it begins its growth as a rounded, fleshy cell, which at maturity bursts and discloses a mass of soft, red matter, having a net-like form, with a nauseous odor. This fleshy mass emits an inconceivable quantity of spores, as the generative dust of fungi is termed. It is utterly impossible to eradicate the plant from any spot where it has once distributed its fruit, for the reason that out of these million of reproductive germs, some must inevitably escape any destructive agency. I have known single fungi to appear in places never before detected, and then disappear for years. These spores are so minute that they float in the air like dust, are borne on the percolating water beneath the soil, and are spread abroad by so many natural conveyances that their destruction is impossible. They do not always reappear. Years may pass without their recurrence, and then suddenly, owing to atmospheric influences, these spores, lying perdu in the earth, will germinate luxuriantly.

There are figures of species of Clathrus in many mycological works. Some of them must be very handsome. Should your plant reappear, I would suggest that you should carefully take it up and preserve it in alcohol. By sending it to the NATURALIST the identity could be established.

I should try a dose of carbolic acid, which is not expensive, and could be freely watered over the spot where the fungus appears. Dilute sulphuric acid would prevent the germination of those spores which it touched.—C. J. S.

We also append an account of the European Clathrus from Cooke's "Plain and Easy Account of British Fungi." The second family of fungi is termed Gasteromycetes (*gastes* Gr., a stomach; *mukes*, a mushroom) which have the hymenium or spore bearing surface, enclosed within a covering called a peridium (from *perideo*, Gr. I wrap round) so that all the spores are produced and ripened within a kind of stomach or *gastes*.—Every one knows the puff-ball, a spherical pouch, containing, when ripe, an almost impalpable brownish dust, not unlike Scotch snuff, and which mischievous school boys delight in puffing in each other's faces. The pouch is the peridium or stomach, and the brown dust the innumerable ripened spores.

Certain fungi having this structure are subterranean in habit; in them the hymenium does not become dusty, but remains permanent; nor does it melt away as in other groups, except when it becomes decayed. One of the most striking in appearance, disgusting in odor, and noxious in properties of all fungi, is the Latticed Stinkhorn (*Clathrus cancellatus*) which is, however, so rare as scarcely to merit a notice here except to call attention to its most commendable feature, that of the beauty and singularity of its form. The receptacle resembles a spherical net work or lattice work of coral, but is of so putrescent a nature that its odor materially detracts from its beauty; M. Roques relates of its properties that a young person having eaten a morsel was seized with violent convulsions, lost the use of her speech, and ultimately fell into a stupor which lasted forty-eight hours: prompt attention was given to her, but it appears to have been some months before she was perfectly cured.

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